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Module 1

Mathematics 6

Estimating and Representing Number

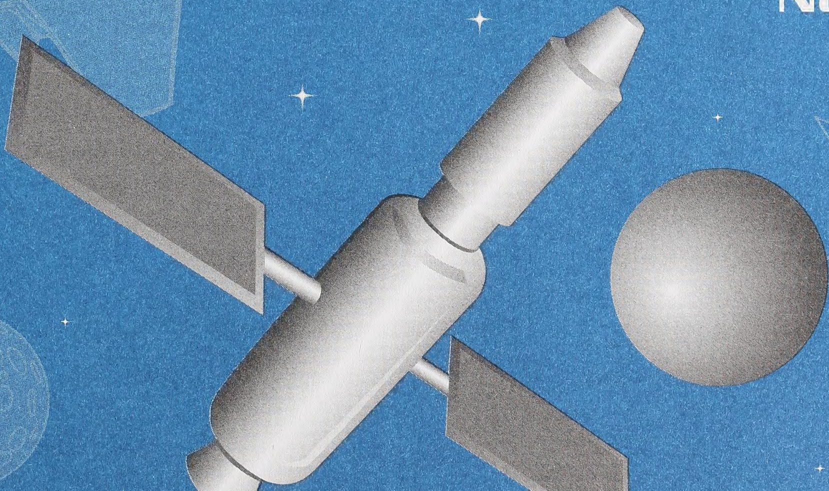
Learning Technologies Branch

Alberta LEARNING

Mathematics 6

Module 1

Estimating and Representing Number



Learning Technologies Branch

Alberta LEARNING

Mathematics 6
Module 1: Estimating and Representing Number
Student Module Booklet
Learning Technologies Branch
ISBN 0-7741-2179-3

The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Student Module Booklet.

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

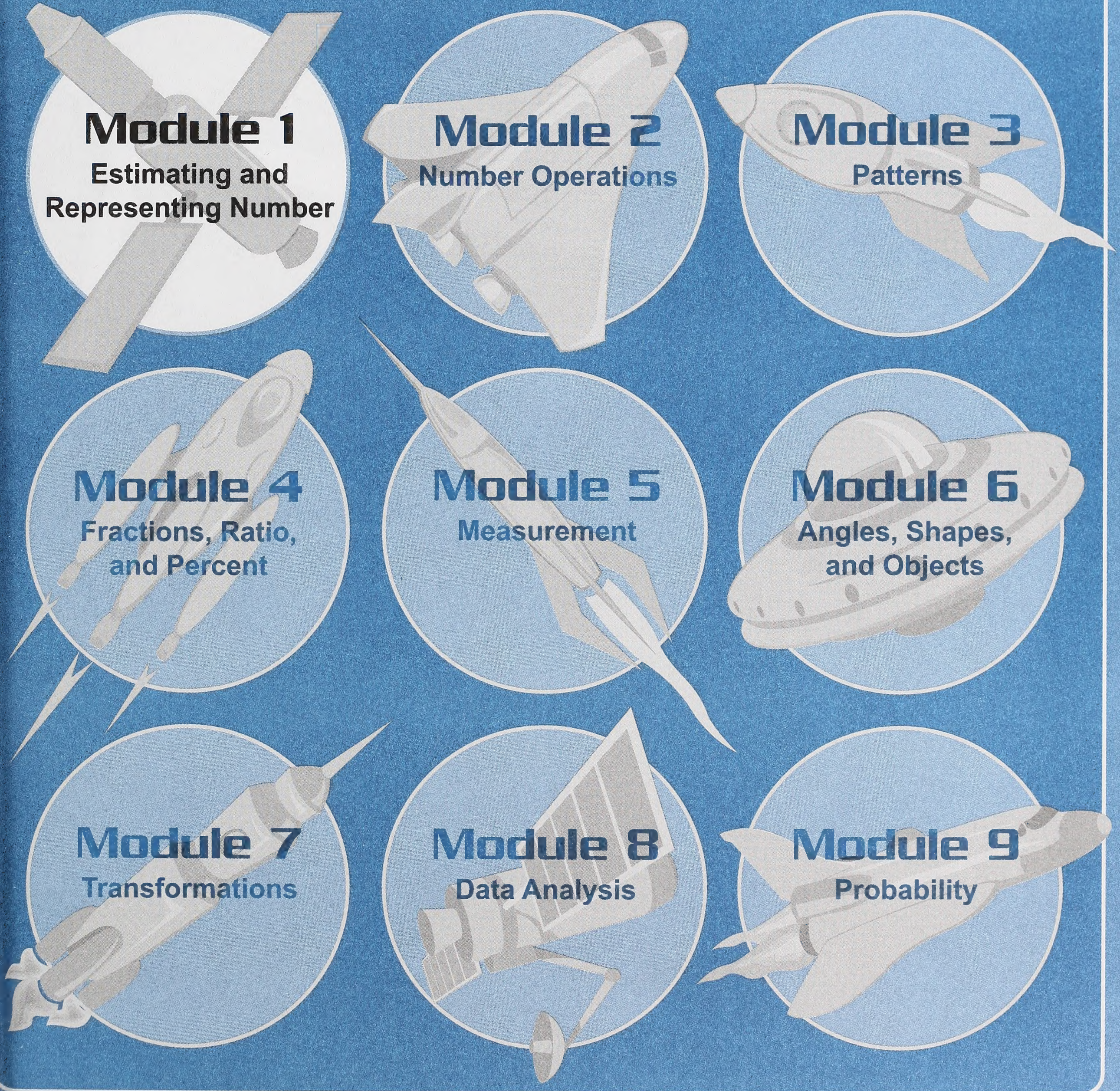
You may find the following Internet sites useful:

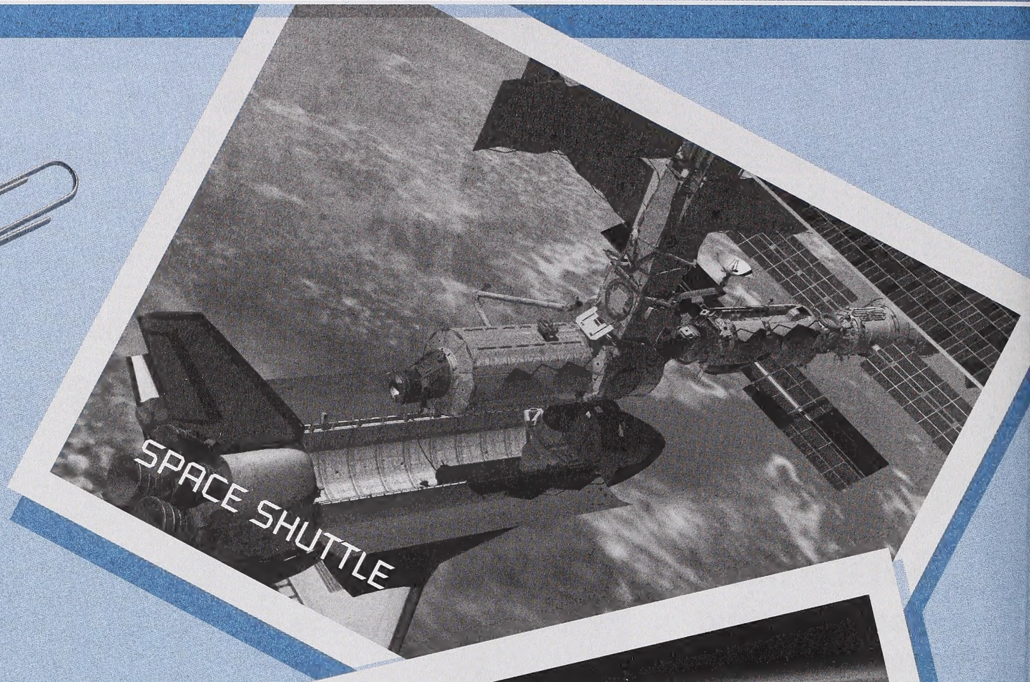
- Alberta Learning, **http://www.learning.gov.ab.ca**
- Learning Technologies Branch, **http://www.learning.gov.ab.ca/ltb**
- Learning Resources Centre, **http://www.lrc.learning.gov.ab.ca**

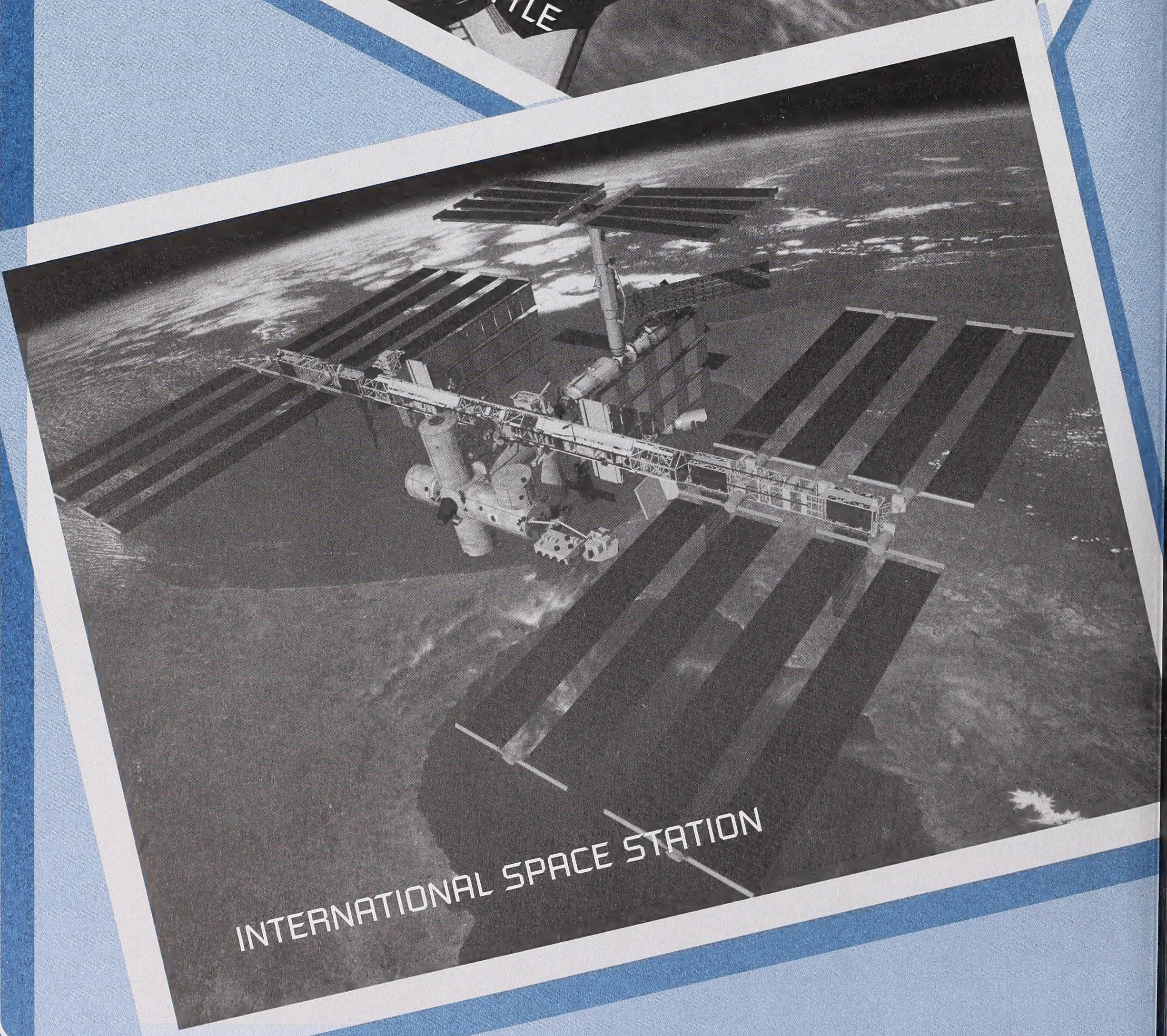
The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

Welcome to Mathematics 6

Mathematics 6 contains nine modules.
You should work through the modules in order (from 1 to 9) because concepts and skills introduced in one module will be reinforced, extended, and applied in later modules.




SPACE SHUTTLE


INTERNATIONAL SPACE STATION

Adventures in Outer Space

Matthew: Wow, what a wonderful experience it was meeting Colonel Chris Hadfield at the Odyssium! He gave a presentation here in Edmonton on July 9, 2001, and talked about his adventures in space, including his mission aboard the Space Shuttle *Endeavor* to attach Canadarm2 to the International Space Station.

It's too bad you missed it, Kylee. You were away visiting your grandmother in Slave Lake.

Kylee: My trip was great, but I sure wish I could have heard Colonel Hadfield talk about being the first Canadian to walk in space. But, I've got great news for you, Matthew! Commander Claire from the International Space Station is coming to town, and you and I will be spending some time with her.

I can't wait to hear about her adventures in space!

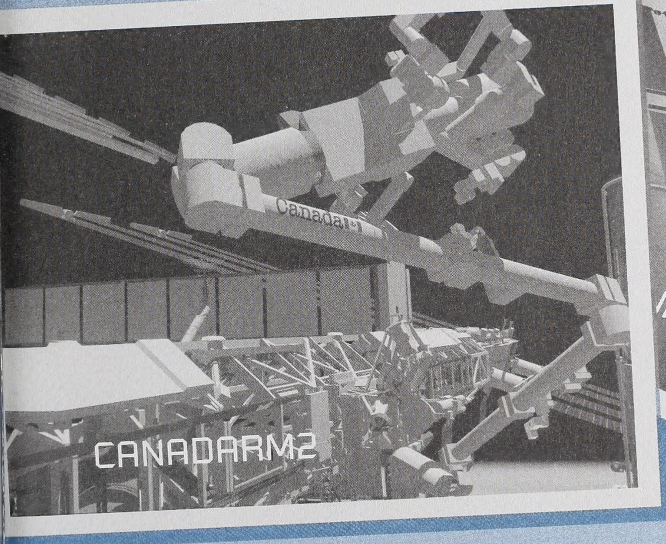
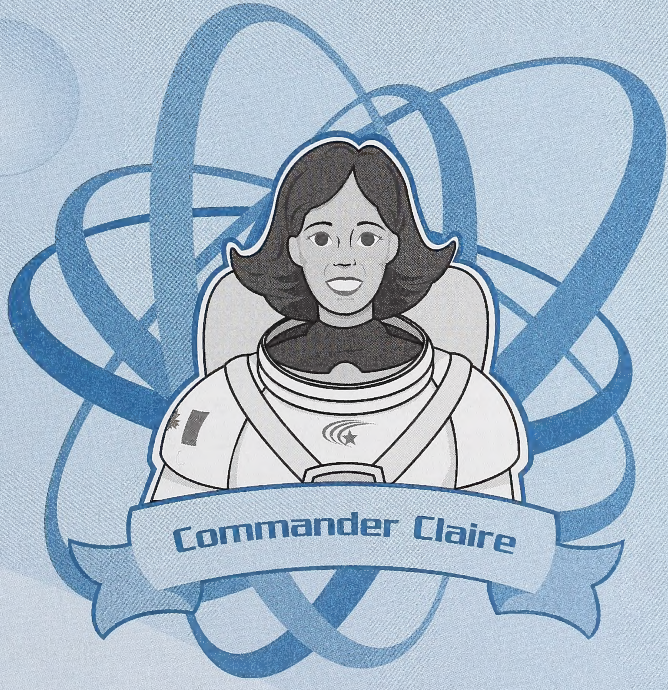


Table of Contents


Commander Claire

Course Features

Take the time to look through the Student Module Booklets and the Assignment Booklets and notice the following design features:

- Each module has a Module Overview, Module Summary, and Review.
- Each module has several lessons. Each lesson focuses on a big idea that is central to the topic being learned in the module.
- Each lesson has several activities. An activity in each lesson is related to the Adventures in Outer Space theme.
- Each module has a Glossary and an Answer Key in the Appendix. In several modules there are also special pull-out pages in the Appendix.
- Each module has special exercises that focus on certain mathematical skills. The Numbers in the News project involves a scavenger hunt for samples of math in everyday life. The Keystrokes exercise introduces some “funky features” of the calculator that can be used to explore and practise important number ideas. Just the Facts gives you the opportunity to practise your basic number facts by doing a timed drill with your home instructor. The Mental Math exercise introduces an estimation skill or mental-computation strategy that you can use to sharpen your mental math skills.
- Each module references the Mathematics 6 Companion CD that includes additional material for review and mastery.

Required Resources

There are no spaces provided in the Student Module Booklets for your answers. This means you will need a binder and loose-leaf paper or a notebook to do your work.

In order to complete the course, you will need a copy of the Mathematics 6 textbook, *Quest 2000: Exploring Mathematics, Grade 6*, the soft-cover book *Quest 2000: Exploring Mathematics: Practice and Homework Book, Grade 6*, a basic four-operation calculator (such as the TI-108 calculator), and various manipulatives (base ten blocks and pattern blocks).

If you wish to complete the optional computer activities, you must have access to a computer that is connected to the Internet.

You will also need access to a computer to view material on the Mathematics 6 Companion CD.

Visual Cues

For your convenience, the most important mathematical rules and definitions are highlighted. Icons are also used as visual cues. Each icon tells you to do something.

Use your calculator.

Use the Internet.

Refer to the textbook or the Practice and Homework Book.

Use the Mathematics 6 Companion CD.

Assessment and Feedback

The Mathematics 6 course is carefully designed to give you many opportunities to discover how well you are doing. In every activity you will be asked to turn to the Appendix to check your answers. Completing the activities and comparing your answers to the suggested answers in the Appendix will help you better understand math concepts, develop math skills, and improve your ability to communicate mathematically and solve problems.

If you are having difficulty with an activity, refer to the Answer Key in the Appendix for hints or help. As well as giving suggested answers to the questions, the Answer Key gives you more information about the questions.

Twice in each module you will be asked to give your teacher your completed assignments to mark. Your teacher will give you feedback on how you are doing.

After your teacher marks an assignment, be sure to review your teacher's comments and correct any errors you made.

There will be a final test at the end of the course. You can prepare for the final test by completing the Review at the end of each module.

Module Overview

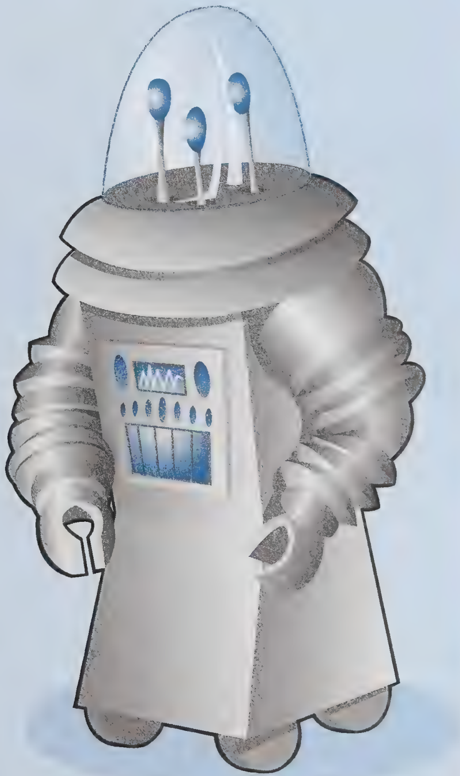
It is difficult to imagine how big the universe is! Light from stars on the edge of the universe takes over 12 billion years to reach Earth! Light from the closest star, the sun, which is about 149 million kilometres away, reaches Earth in just over 8 minutes! And in less than a heartbeat, light could travel from Inuvik, in the Northwest Territories, to Edmonton, Alberta, and back!

Large and small numbers are needed to describe the world around you. In this module you will use large whole numbers to describe distances in space, populations, and money. You will use decimal numerals to describe such things as the sizes of microscopic objects or the batting averages of baseball players. You will review and extend your understanding of place value, and you will apply this knowledge to compare, order, and round numbers. Also, you will learn about numbers called integers, and you will use them to describe things like temperature and land elevation.

Lesson 1
Understanding Large Numbers

Lesson 2
Making Sense of Small Numbers

Lesson 3
Integers



Your mark on this module will be determined by how well you complete the two Assignment Booklets.

The mark distribution is as follows:

Assignment Booklet 1A

Lesson 1 Assignment	30 marks
Lesson 2 Assignment	30 marks

Assignment Booklet 1B

Lesson 3 Assignment	30 marks
Numbers in the News	10 marks
Total	100 marks

When doing the assignments, work slowly and carefully. Be sure you attempt each part of the assignments. If you are having difficulty, you may use your course materials to help you, but you must do the assignments by yourself.

You will submit Assignment Booklet 1A to your teacher before you begin Lesson 3. You will submit Assignment Booklet 1B to your teacher at the end of this module.

Numbers in the News

Read through the following list before you begin Module 1. Begin by collecting samples of the ideas you already understand; others you may collect as you learn about them in the module. The samples you collect will depend on the newspapers or magazines you use.

Scavenger Hunt

Cut out articles or advertisements from newspapers or magazines that show large numbers, decimals, and integers being used in different situations. Here are some suggestions of things to look for:

- numbers in millions or billions
  - as numerals or in words
  - estimates or exact amounts

- decimals that represent thousandths
  - batting averages or other sports statistics
  - measurements

- integers used for various purposes
  - temperatures
  - elevations or depths
  - rating scales
  - stock market

You will find further instructions for completing and submitting your project in Assignment Booklet 1B.

Lesson 1

Understanding Large Numbers

NASA

The astronauts in the photograph are training for a mission to Mars. They are training in a crater created by a meteorite on Devon Island, Nunavut. The island setting provides a cold, rocky, and desert environment that comes closest to the conditions astronauts will experience on Mars.

Would you like to be on the first Mars mission? Mars, even when closest to Earth, is still more than 56 million kilometres away! The trip to Mars and back will take more than two years to complete.

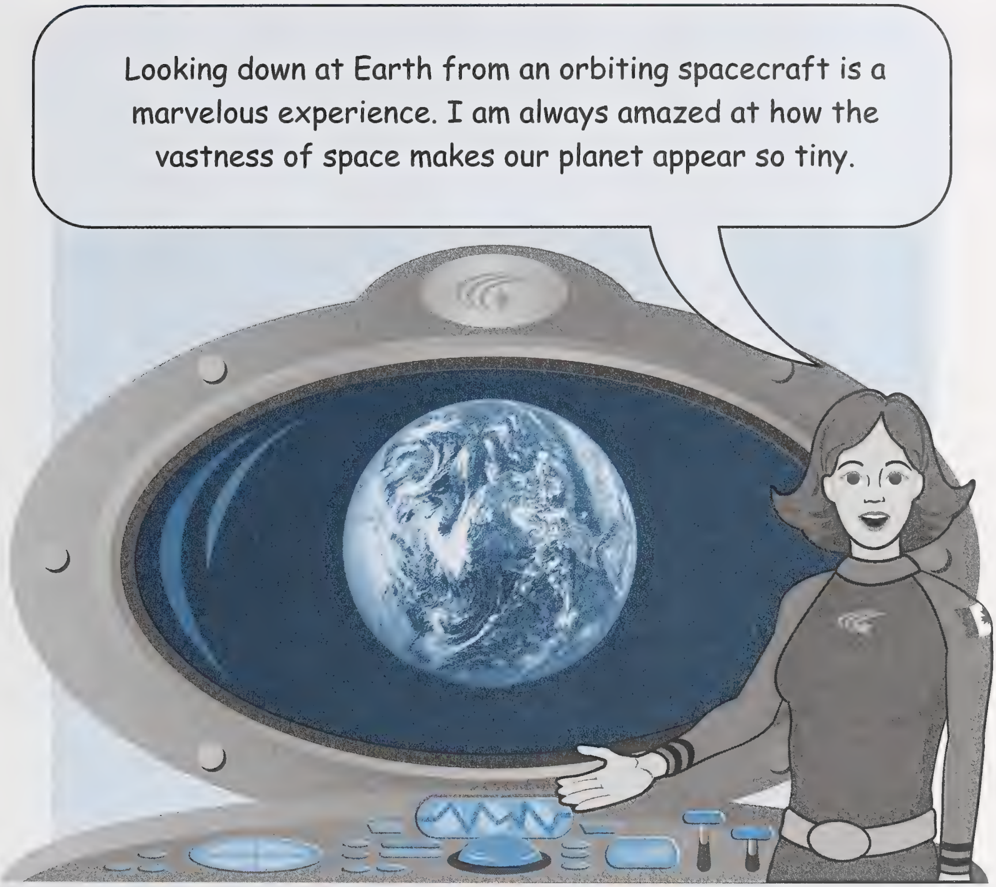
You can find out more about Devon Island and the NASA astronauts at the following website:

http://www.arctic-mars.org/

In this lesson you will extend your knowledge of large numbers, such as the numbers that are needed to describe distances in space. You will make models and use place-value charts to represent large numbers. You will review place value by reading, writing, comparing, ordering, and rounding large numbers.

Activity 1

Today you will use large numbers.



The vast distances in space are difficult to imagine.

Example

Earth travels through a distance of over 100 000 km every hour. If you sleep for 10 h, how far does Earth travel while you are asleep?

In 1 h, Earth travels 100 000 km. In 10 h, Earth travels $10 \times 100\ 000$ km, or 1 000 000 km.

While you are asleep, Earth travels over 1 000 000 km, or 1 million kilometres.

Remember, one million has six zeros. You will use the concept of one million in the following questions.

1. The following table shows the distance (in millions of kilometres) that each of the nine planets is from the sun. Copy and complete the table in your notebook by writing each distance in kilometres.

Planet	Distance from the Sun (millions of km)	Distance from the Sun (km)
Mercury	58	
Venus	108	
Earth	150	
Mars	228	
Jupiter	778	
Saturn	1429	
Uranus	2871	
Neptune	4504	
Pluto	5913	

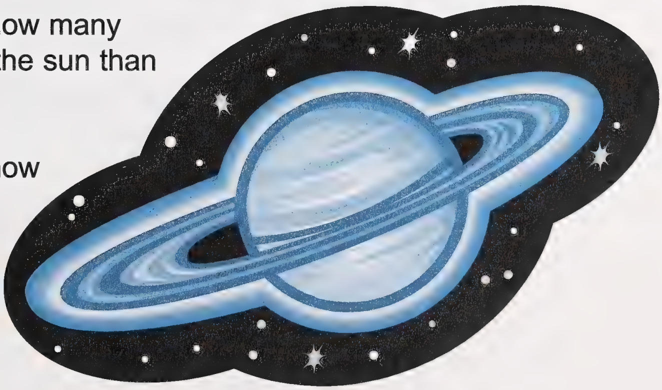
2. a. Which planet is about two times farther from the sun than Saturn is? Explain.

   b. Which planet is about 100 times farther from the sun than Mercury is? Explain.

   c. Which planet is about 4 times farther from the sun than Jupiter is? Explain.

   d. Neptune is about how many times farther from the sun than Mars is? Explain.

   e. Neptune is about how many times farther from the sun than Earth is? Explain.



3. Using the table in question 1, write, in words, the distance in kilometres each of the following planets is from the sun.

   a. Mercury   b. Earth   c. Pluto

Check your answers on pages 87 and 88 in the Appendix.

4. The following table shows the diameter of the sun and each of the nine planets.

Body	Diameter (km)
Sun	1 392 000
Mercury	4878
Venus	12 104
Earth	12 756
Mars	6787
Jupiter	142 800
Saturn	120 000
Uranus	50 800
Neptune	48 600
Pluto	2300

   a. Write the names of the planets in order, from the one with the least diameter to the one with the greatest diameter.

   b. Which planet has the greatest diameter? Write, in words, its diameter in kilometres.

   c. Which planet has the least diameter? Write, in words, its diameter in kilometres.

   d. Which planet's diameter is about one-tenth of the sun's diameter?

e. Which two planets are closest in size? Which two planets are next closest in size?

f. Which planet's diameter is about 10 times greater than Venus's diameter?

g. Which planet's diameter is about half the size of Mercury's diameter?

Check your answers on page 88 in the Appendix.

5. Red Deer is about 150 km south of Edmonton and about 150 km north of Calgary.

   a. How does the distance of 150 km compare with the distance between Earth and the sun?

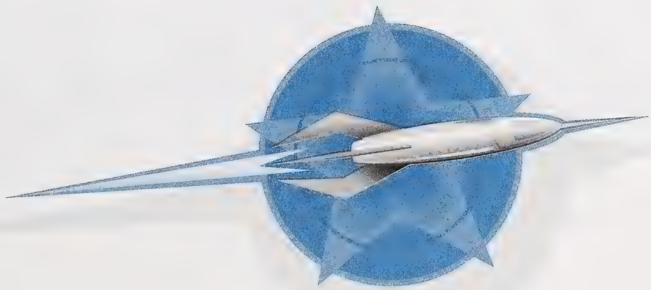
   b. If you drive at a rate of 100 km/h, how long will it take you to travel from Red Deer to Calgary?

   c. If you could drive to the sun at a rate of 100 km/h, how many years would it take you?

6. The greatest east-west distance in Canada is 5514 km, stretching from Cape Spear, Newfoundland, to the Yukon-Alaska border.

   a. Which planet has a diameter that is closest to this distance?

   b. The moon is about 384 321 km from Earth. About how many trips would you have to make across Canada to travel the same distance?



7. What did you learn about distances in Alberta and Canada, compared to distances in space?

Check your answers on page 89 in the Appendix.

Question 8 is optional. Complete it if you have time. The activity outlined will give you a better picture of the solar system.

8. To help you to visualize relative distances and sizes in space, you can make a rough scale model of the solar system. You may have to set it up outside because of the large distances involved.

Begin by finding or making a model with a 1-m diameter to represent the sun. Following are some ideas for what you could use:

- a large (oversize) beach ball
- a large cardboard box from a washing machine or dryer
- two hula hoops taped together at right angles and draped with a large blanket
- a circle with a diameter of 1 m cut from newspaper (You'll need to tape several sheets of newspaper together.)

Use modelling clay to make spheres for the planets with the diameters shown in the following table. (**Note:** In the table, the diameters of the planets are proportional to each other, and the distances the planets are from the sun are proportional to each other. However, it was necessary to use different scales for the two columns because of the tremendous distances between the planets. In fact, the distance between Mars and the sun is over 150 times greater than the diameter of the sun.)

Planet	Model Diameter (mm)	Model Distance from Sun
Mercury	3.5	25 cm
Venus	8.7	47 cm
Earth	9.2	66 cm
Mars	4.9	1 m
Jupiter	103	3.41 m
Saturn	86	6.27 m
Uranus	36	12.59 m
Neptune	35	19.75 m
Pluto	1.7	25.93 m

Scale: Diameter of sun = 1 m
Distance from Mars to sun = 1 m

Use a metre-stick to help you put your sun and planet models in their proper positions. Because the models of the planets are so tiny, you may want to put each planet model on an index card. This way, once your solar system is built and you go walking around in it, it will be easier for you to see where all of the planets are. Draw a picture that shows approximately what your model looks like.

Check your answer on page 89 in the Appendix.

Activity 2

Today you will explore **place value**.

You may find it difficult to imagine how much 1 million is because it's unlikely that you've ever had that many of anything! If you had a million blocks, and counted one of them every second, it would take you over 11 days to count them all!

1. To help you visualize 1 million, you can use small base ten cubes or centicubes.

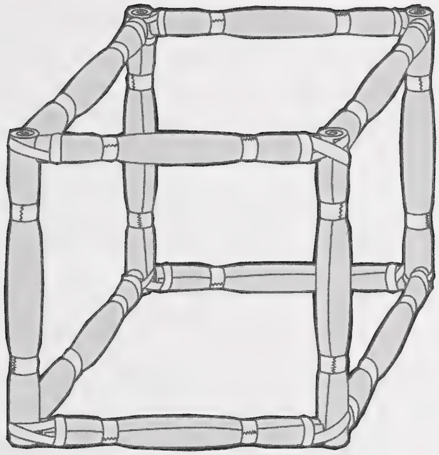
Use newspaper to make a square with sides that measure 1 m each. Imagine trying to cover this square with centicubes.

a. How many rows of centicubes would you need? (**Hint:** Lay a metre-stick along one edge of your newspaper square.) Explain.

b. How many centicubes would you need to put in each row? Explain.

c. How many centicubes would you need for the whole layer? Explain.

2. Nina rolled newspaper sheets and taped them together to make 12 tubes that were each 1 m in length. She taped the tubes together to build a skeleton of a cubic metre. Imagine stacking layers of centicubes to make this cube.



If you have time, make a newspaper model like Nina's.

a. How many layers of centicubes would you need to make a cube with edges that measure 1 m each?

b. How many centicubes would you need to make a 1-m^3 cube? Explain.

3. Nina estimated that if she had enough centicubes, and she snapped them together at a rate of one centicube per second, it would take her about two weeks to build a 1-m^3 cube with centicubes. Do you agree with Nina? Explain.

4. Visualize the large cube described in question 3. Pretend it is hanging down from the ceiling on wires, and all six faces are painted.

a. How many centicubes on each face of the cube would have some paint on them? Explain.

b. Use your answer to question 4.a. to estimate how many centicubes in the entire cube would have some paint on them? Explain.

c. If all of the centicubes that have paint on them are removed from the cube, what would be the dimensions of the remaining cube? Explain.

d. Exactly how many centicubes wouldn't have paint on them? Explain.

e. Exactly how many cubes would have paint on them? Explain.

f. How does your answer for question 4.b. compare with your answer for question 4.e.? Explain.

Check your answers on pages 90 and 91 in the Appendix.

You can see how very large 1 million is! You can use a place-value chart and counters to represent numbers that are much greater than 1 million.

Example

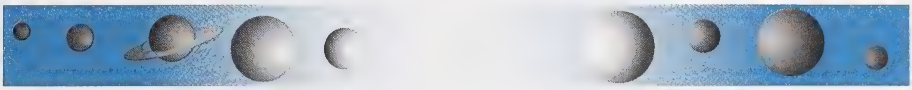
The counters on the following place-value chart represent the number 249 538 167.

MILLIONS			THOUSANDS		
Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands
●●	●●●●	●●●●● ●●●●	●●●●●	●●●	●●●●● ●●●
2	4	9	5	3	8

ONES		
Hundreds	Tens	Ones
●	●●●●● ●	●●●●● ●●
1	6	7

$$249\ 538\ 167 = 200\ 000\ 000 + 40\ 000\ 000 + 9\ 000\ 000 + 500\ 000 + 30\ 000 + 8000 + 100 + 60 + 7$$

Notice that the digits in the number are written in sets of three called **triads**. The triad of digits on the left represents the numbers of millions, the triad of digits in the middle represents the number of thousands, and the triad of digits on the right represents the number of ones. The **expanded numeral** is shown below the place-value chart. The standard form of the number is 249 538 167. This is written and read as "two hundred forty-nine million five hundred thirty-eight thousand one hundred sixty-seven."



5. For each number, copy the following place-value chart into your notebook. Draw counters to represent the numbers given. Write each number as an expanded numeral and in words.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones

   a. 438 156 229
   b. 590 341 783
   c. 935 412 078

Check your answers on pages 91 and 92 in the Appendix.

The largest number of counters you can have in any column on the chart is 9. If you have more than 9, you must regroup.

Example

Show how you would regroup the counters on the following place-value chart, and then write the resulting number in standard form.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
●●	●	●●●●● ●●●●● ●	●		●●	●		●●●●● ●●●●● ●●

There are 12 counters in the Ones column. Since $12 = 10 + 2$, put 1 counter representing the 10 in the Tens column and leave 2 counters in the Ones column.

Tens	Ones
●	●●

$$\begin{aligned} 1 \text{ ten and } 2 \text{ ones} &= (1 \times 10) + (2 \times 1) \\ &= 10 + 2 \\ &= 12 \end{aligned}$$

There are 11 counters in the Millions column. Since $11 = 10 + 1$, put 1 more counter in the Ten Millions column and leave 1 counter in the Millions column.

Ten Millions	Millions
●●	●

$$\begin{aligned} 11 &= 10 + 1 \\ &= (1 \times 10) + (1 \times 1) \end{aligned}$$

Regrouped, the chart should look like this.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands
●●	●●	●	●		●●

Hundreds	Tens	Ones
●	●	●●

In standard form, the number is 221 102 112.

6. For each of the following place-value charts, show how you would regroup the counters, and then write the resulting number in standard form.

a.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands
●●●	●●●●● ●●●●	●●●●● ●●●●● ●●●	●		●●●●● ●●●●

Hundreds	Tens	Ones
●●●●● ●●●●● ●●●●	●●●●● ●●●●	●●●●● ●●●●● ●●

b.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
●●●	●●●●●●●●●●	●●●●●●●●●●●●●●	●●●●●●●	●●●●●●●●●●●●	●●●●●●●●●●●●●	●●●●	●●●●●●●●	●●●●●●●●●●●

c.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
●	●●●●●●●●●●	●●●●●●●●●●●	●●●●●●●●●●●●●		●●●●●●●●●	●●●●●●●●●	●●●●●●●●●●	●●●●●●●●●●

Check your answers on pages 93 and 94 in the Appendix.

Activity 3

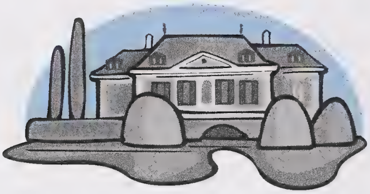
Today you will estimate numbers up to 1 million.

Many people dream about what they would do with $1 million. What would you do? What would you buy? How much would you save? How would you use it to help make the world a better place to live in?

Turn to pages 40 and 41 in your textbook.

1. Look at the list of luxury items and their prices on page 40.

   a. Name the least expensive item and its price.
   b. Name the most expensive item and its price.



2. Imagine having $1 million. Think about how you might spend it on yourself and your family members.

   a. Are there any items on the list that you could not afford? Explain.

   b. If you bought the luxury home, what other items could you buy (with no duplicates) so that your total purchases would come to exactly $1 million? Explain.

   c. What is the least number of items you could buy (with no duplicates) for exactly $1 million? List the items and their prices.

   d. Could you spend exactly $1 million by buying several of just one kind of item? Explain.

Check your answers on pages 94 and 95 in the Appendix.

3. Look at the list of people and their earnings on page 41 of the textbook.

   a. About how many times as great as the earnings of Doug Gilmour are the earnings of Steven Spielberg?

   b. About how many times greater are the earnings of Michael Eisner than the earnings of Whitney Houston?

   c. Which person earned close to $\frac{1}{1000}$ of the estimated worth of William Gates?

   d. If you earned \$10 million every year, could you earn the estimated worth of Taikichiro Mori in your lifetime? Explain.

4. The population of Alberta is about 3 million, the population of Canada is about 30 million, and the population of Earth is about 6 billion.

   a. Write each of these three numbers in standard form.

   b. The population of Canada is about how many times greater than the population of Alberta?

   c. The population of Earth is about how many times greater than the population of Canada? Explain.

5. Explain how 1000, 1 000 000, and 1 000 000 000 are related.

Check your answers on page 96 in the Appendix.

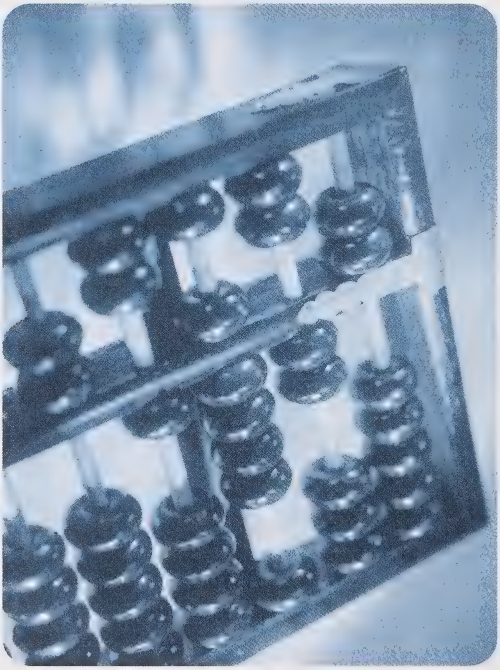
Sharing Time

Now it's time to show your home instructor what you have been learning.

Turn to page 14 of the Practice and Homework Book and complete questions 1 to 9.

Discuss your answers with your home instructor.

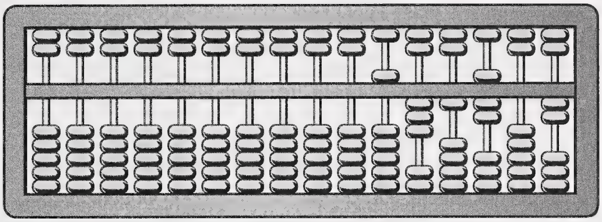
Challenge Activity



Turn to page 71 in your textbook and read A Calculating Machine. (**Correction:** The top abacus shown in the textbook is a Chinese suan pan and the middle abacus is a Japanese soroban.)

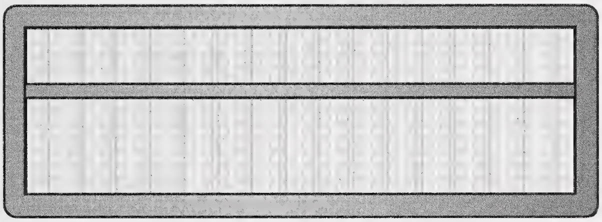
The top beads represent fives. Below the bar, the beads represent ones. The beads are moved towards the bar when they are used to form a number.

The number 531 702 is shown on a Chinese abacus.

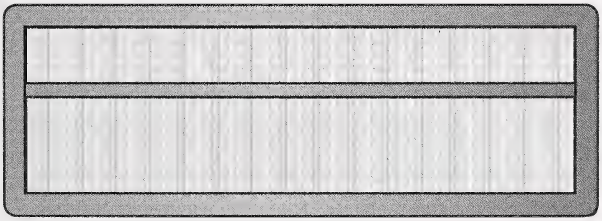


Make abacus diagrams for the following numbers. Outlines are provided for you to trace over.

1. 347 906 185 201



2. 594 230 619 362 780



Check your answers on pages 96 and 97 in the Appendix.

Conclusion

In this lesson you saw how numbers greater than 1 million are used to describe distances in space, populations, and money. You extended your understanding of large numbers by making models and by using place-value charts to represent them. You reviewed place value by reading, writing, comparing, ordering, and rounding large numbers.

NASA

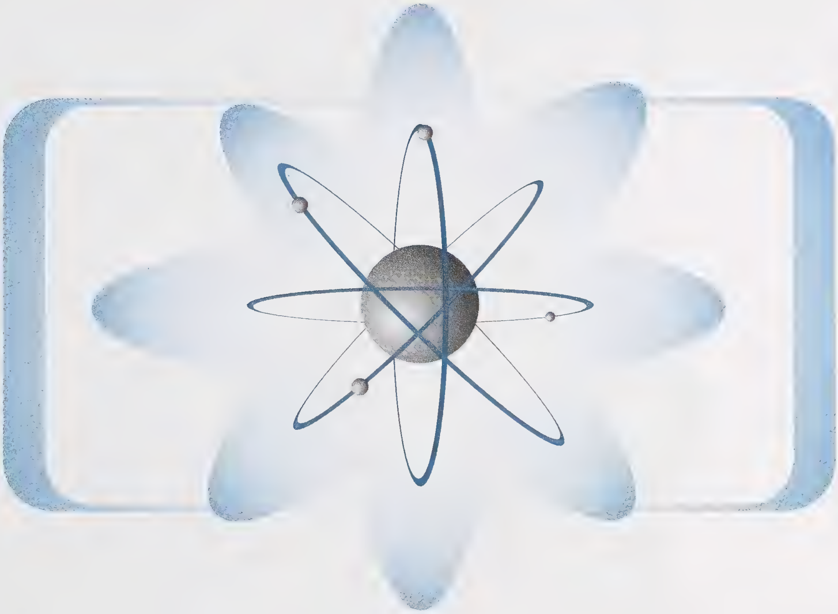
Large numbers are second nature to astronauts who prepare for long journeys into space. A journey to Mars and back will take more than two years to complete. To help them prepare for their time on Mars, astronauts have been training at Devon Island, Nunavut. Look on a map to see where it is located and how far it is from where you live.

Turn to Assignment Booklet 1A and complete the Lesson 1 Assignment.

Keep Assignment Booklet 1A until you have completed the entire booklet.

Lesson 2

Making Sense of Small Numbers



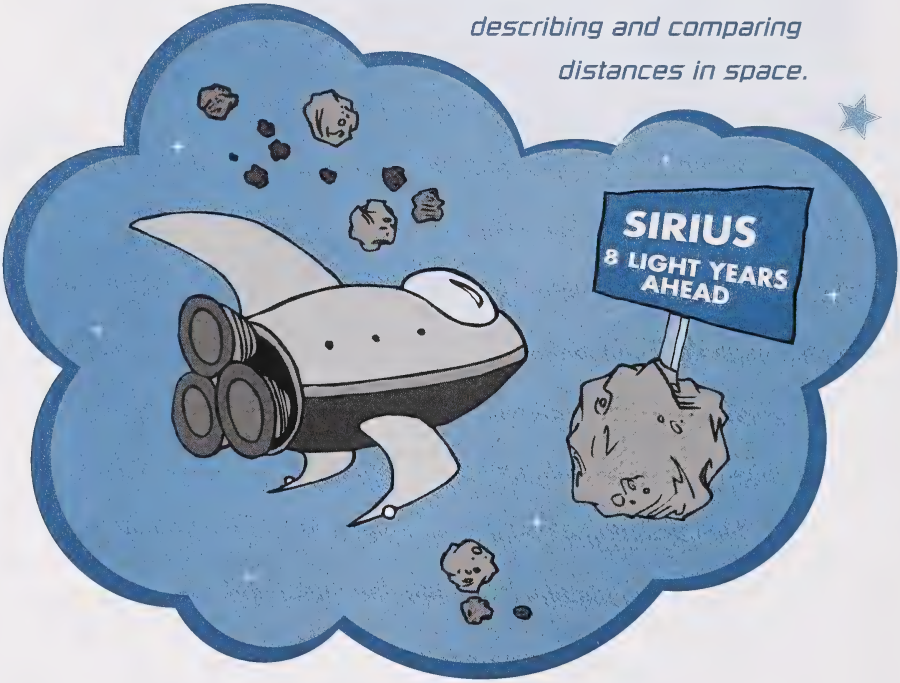
Scientists must use very small numbers to represent the tiny world of the atom. A useful way to think of atoms is to compare them to planetary systems. You can think of the nucleus of an atom as the sun. Travelling around the nucleus of the atom, like planets travelling around the sun, are clouds of electrons.

Very small numbers are often needed for measuring length, area, volume, capacity, mass, temperature, time, and money. In this lesson you will extend your understanding of decimals used to represent small numbers by using base ten blocks and place-value charts. You will review place value by reading, writing, comparing, ordering, and rounding decimals.

Activity 1

Today you will represent small numbers using decimal numerals.

Standard units of measurement used on Earth are often inadequate for describing and comparing distances in space.



To make sense of small numbers, you need to understand large numbers, like those you studied in Lesson 1. For example, if the mass of Jupiter is one-thousandth (0.001) of the mass of the sun, that means that the mass of the sun is one thousand (1000) times as great as the mass of Jupiter. So, in order to make sense of thousandths, you need to understand thousands.

The following table shows how place values to the left of the ones place are related to place values to the right of the ones place.

Thousands	Hundreds	Tens	Ones
1000	100	10	1

Tenths	Hundredths	Thousandths
$0.1=\frac{1}{10}$	$0.01=\frac{1}{100}$	$0.001=\frac{1}{1000}$

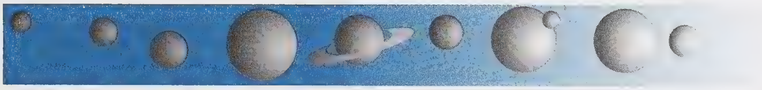
Example

Write 2.53 in words.

Notice, 2.53 is more than 2. Because there are two decimal places, the digit 3 is in the hundredths place.

$$2.53 = 2\frac{53}{100}$$

The decimal point tells you to use the word *and* because 2.53 is 2 *and* 53 hundredths more. Therefore, 2.53 is two and fifty-three hundredths.



Have you ever heard the phrase “astronomically large” used to describe a number or a measure that is so great it is hard to imagine? Distances in space are so huge compared to distances on Earth that astronomers use **astronomical units** to measure them. An astronomical unit (**AU**) is the average distance from the centre of Earth to the centre of the sun.

1 AU = 149 597 870 691 m (about 150 million kilometres)

1. The following table shows the distance in astronomical units that each of the planets is from the sun. Copy and complete the table in your notebook by writing each distance as a decimal or in words.

Planet	Distance from Sun (AU)	Distance from Sun (AU) in Words
Mercury	0.387	three hundred eighty-seven thousandths
Venus	0.723	
Earth	1	one
Mars		one and five hundred twenty-four thousandths
Jupiter	5.203	
Saturn		nine and five hundred fifty-seven thousandths
Uranus		nineteen and one hundred sixteen thousandths
Neptune	30.002	
Pluto		thirty-nine and four hundred seventy thousandths

Check your answers on page 97 in the Appendix.

Another very important number for astronomers is the speed of light.

Speed of light = 299 792 458 m/s (about 300 million metres per second)

In 1983, the metre was defined as the distance light travels in a vacuum in $\frac{1}{299\ 792\ 458}$ s.

2. **a.** Write, in words, the speed of light in metres per second.

   b. Write, as a number, the speed of light in kilometres per second.

   c. Round your answer to question 2.b. to the nearest hundred thousand kilometres per second.

3. If you could travel at the speed of light, explain how you would estimate how long it would take you to travel the following distances.

   a. to the sun, which is about 150 000 000 km (1 AU) from Earth
   b. to the Moon, which is 384 321 km from Earth

Check your answers on pages 97 and 98 in the Appendix.

When calculating distances beyond our solar system, even astronomical units seem too small! The sun is the closest star to Earth. Distances to other stars in the universe are measured in **light-years**. A light-year is the distance that light travels in one year.

1 light-year = 9 461 000 000 000 km (about 9.5 trillion kilometres)

4. The following table shows the distance in light-years some stars are from Earth.

Name of Star	Distance from Earth (in light-years)
Sirius	8.64
Rigel Kentaurus	4.3
Arcturus	34
Vega	25
Capella	41
Achernar	69
Betelgeuse	520
Proxima Centauri	4.22
Alpha Centauri	4.35
Bernard's Star	5.98
Luyten 726-8	8.43

a. List the distances of the stars from Earth in order, from the least number of light-years to the greatest number of light-years.

b. Which star is about 0.5 of the distance that Achernar is from Earth? Explain.

c. Which star is about 0.5 of the distance that Sirius is from Earth? Explain.

d. Which star is about $\frac{1}{20}$ of the distance that Betelgeuse is from Earth? Explain.

You may think you have seen the greatest possible unit for measuring distance, but there is one that's more than 3 times greater than a light-year. It's called a **parsec**. Its abbreviation is **pc**. This distance is about 30.86 trillion kilometres or 206 265 AU!

$$1 \text{ pc} = 3.26 \text{ light-years}$$

Questions 5 and 6 are optional. Complete them if you have time to see how distances in space are measured.

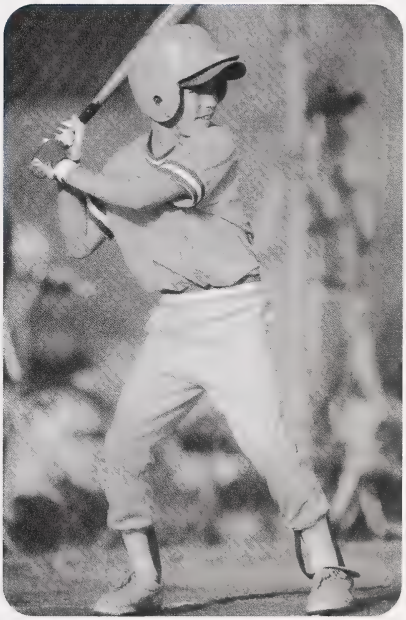
5. A parsec is about 206 265 times greater than an astronomical unit. An astronomical unit is what fraction of a parsec?

6. The closest star to Earth, outside our solar system, is Proxima Centauri. The farthest known star from Earth is farther than 3 million parsecs away. Compared to the size of our universe, is a parsec a large distance? Explain.

Check your answers on page 98 in the Appendix.

Activity 2

Today you will apply your knowledge of small numbers.



A baseball player's batting average is calculated by dividing the number of hits by the number of times at bat. The quotient is rounded to the thousandths place. When this decimal is read as a whole number, it tells you how many times you would expect the player to hit the ball for every 1000 times at bat.

Example

A batting average of 0.500 means a batter would hit the ball 500 times for every 1000 times at bat.

$$0.500 = \frac{500}{1000}$$

Since $\frac{500}{1000} = \frac{1}{2}$, you would expect the batter to hit the ball half the time!

The table shows the batting averages of some all-time major league leaders. For example, Babe Ruth's batting average is three hundred forty-two thousandths. However, most baseball fans simply say "three forty-two." Use the table to answer the questions that follow.

Name	Batting Average
Babe Ruth	0.342
Jackie Robinson	0.311
Lou Gehrig	0.340
Spud Davis	0.308
Ty Cobb	0.366
Ted Williams	0.344
Joe DiMaggio	0.325
Joe Jackson	0.356
Riggs Stephenson	0.336
Hank Greenberg	0.313

1. Name the player with the greatest batting average, and write his average in words.

2. Name the player with the least batting average, and write his average in words.

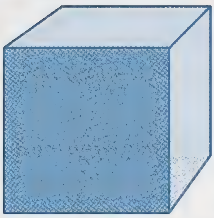
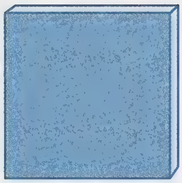
3. Write the ten batting averages in order, from greatest to least.

4. Ted Williams once remarked that baseball players who fail only seven times out of ten attempts will be the greatest in the game. Do you agree? Explain.

Check your answers on page 99 in the Appendix.

You can use base ten blocks to represent batting averages. For example, if the large block represents 1000 times at bat, then a batting average would be represented by a fraction of that block.

5. Copy and complete the following table in your notebook by filling in the number of hits represented by each base ten block, the batting average as a fraction, and the batting average as a decimal.

Name	**Large Cube**	**Flat**	**Rod**	**Small Cube**
Picture				
Number of Hits Represented	1000		10	
Batting Average as a Fraction		$\frac{100}{1000}$		$\frac{1}{1000}$
Batting Average as a Decimal	1.000		0.010	

6. Represent the batting average of each of the following players with base ten blocks, and draw a picture to show your work.

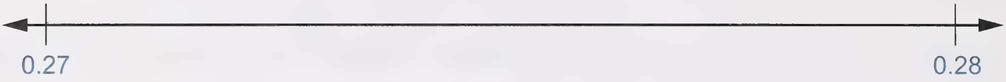
   a. Babe Ruth
   b. Joe DiMaggio
   c. Jackie Robinson

Check your answers on pages 99 and 100 in the Appendix.

A player who makes 123 hits in 450 times at bat would have a batting average of $\frac{123}{450} = 123 \div 450$.

If you use a calculator, you get $123 \div 450 = 0.2733333$. This means that the batting average is between 0.27 and 0.28.

7. To decide if 0.2733333 is closer to 0.27 or 0.28, look at the following close-up of the number line that shows hundredths. Write, in words, the difference between 0.27 and 0.28.



8. In the following close-up of the number line, the distance between 0.27 and 0.28 is divided into ten equal parts. Therefore, each part represents one-tenth of one-hundredth (or one thousandth). Thousandths are represented by three-digit decimals. Copy the number line in your notebook and finish labelling the marks to show what numbers they represent.

9. Circle the number that is halfway between 0.27 and 0.28, and write it in words.

10. Explain how you can use the number line in question 8 to help you decide how to round 0.2733333 to the nearest hundredth.

11. Explain how you might round 0.275 to the nearest hundredth.

Check your answers on pages 100 and 101 in the Appendix.

Do you remember the rules for rounding? Work through the following example.

Example

Round 2.845 to the nearest hundredth, tenth, and unit (ones).

To round 2.845 to the nearest hundredth, look at the thousandth place.

Hundredths

$$\overset{\downarrow}{}$$

2. 8 4 5

$$\overset{}{\uparrow}$$

Thousandths

If the number in the thousandths place is 5 or larger, round up. If it is less than 5, do not change the hundredths place. In this case it is a 5, so raise the hundredths up to a 5. The answer is 2.85.

To round 2.845 to the nearest tenth, look at the hundredths place.

Hundredths

$$\overset{\downarrow}{}$$

2. 8 4 5

$$\overset{}{\uparrow}$$

Tenths

Since the number in the hundredths place is less than 5, leave the tenths as an 8. The answer is 2.8.

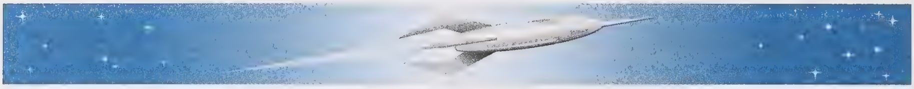
To round 2.845 to the nearest unit (ones), look at the tenths place.

Tenths

2. 8 4 5

Ones

Since the number in the tenths place is larger than 5, raise the ones to a 3. The answer is 3.



12. The following table shows the batting averages of some all-time leaders. Round each batting average to the nearest hundredth. The first one is done for you.

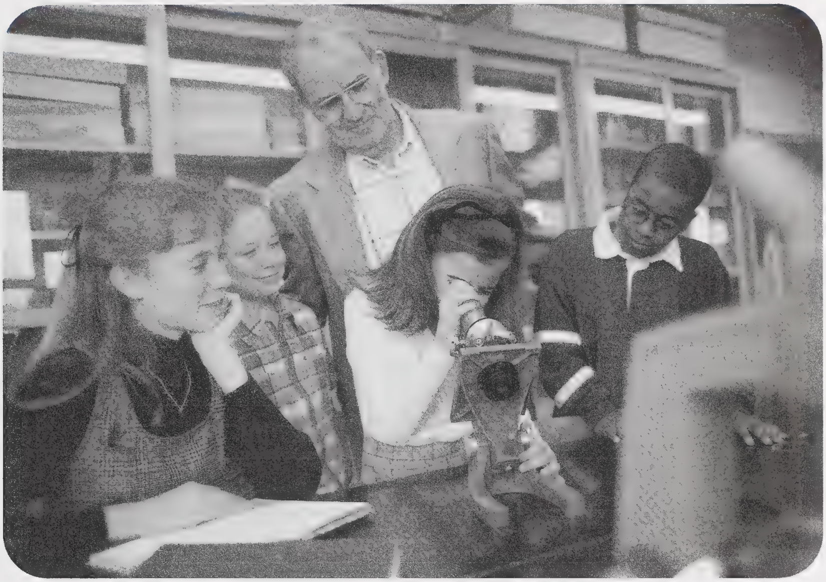
Name	Batting Average	Batting Average (Rounded)
Rogers Hornsby	0.358	0.36
Billy Hamilton	0.344	
Harry Heilmann	0.342	
George Sisler	0.340	
Heinie Manush	0.329	
Rod Carew	0.328	
Jimmie Foxx	0.325	
Hugh Duffy	0.324	
Ken Williams	0.319	
Goose Goslin	0.316	

13. If you knew a baseball player had made 298 hits in exactly 1000 times at bat, why shouldn't you need a calculator to find his or her batting average? Explain.

Check your answers on page 101 in the Appendix.

Activity 3

Today you will explore a variety of interesting applications of small numbers.



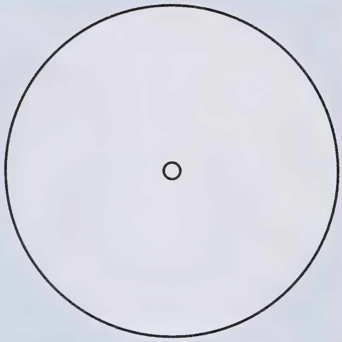
In Activity 1 of this lesson, you saw the need for very large units to measure the vast distances of outer space. In this activity you will learn about units needed to measure very small lengths.

A dime is only 1 mm thick. A millimetre may seem like a very small length to you, but scientists study many things much smaller than that. Because microscopes are needed to study these tiny objects, they are called **microscopic objects**.

Turn to pages 50 and 51 in your textbook. The pictures on page 50 show how some things look under a microscope. The magnification power of a microscope is usually given as a multiple of 20.

The following picture shows how much larger something might look under a microscope.

If the small circle is placed under a microscope with the magnification set at $20\,\mathrm{X}$, it will look like the large circle around it. (**Note:** Its area becomes 400 times larger!)



Today, powerful electron microscopes have a magnification power of more than $200\,000\,\mathrm{X}$. To measure microscopic objects, scientists often use a unit called a **micron**.

$$1 \text{ mm} = 1000 \text{ microns}$$

Example

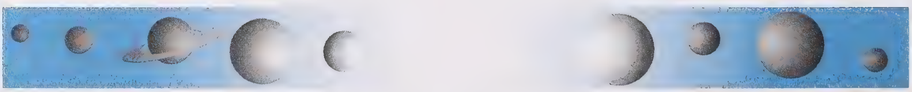
Convert 0.065 mm to microns.

$$\begin{aligned} 0.065 \text{ mm} &= 1000 \text{ microns/mm} \times 0.065 \text{ mm} \\ &= 65 \text{ microns} \end{aligned}$$

Example

Convert 500 microns to millimetres.

$$\begin{aligned} 500 \text{ microns} &= 500 \text{ microns} \div 1000 \text{ microns/mm} \\ &= 0.5 \text{ mm} \end{aligned}$$



1. What fraction of 1 mm is 1 micron? (Write a common fraction and a decimal.)

2. For each of the following, find the diameter in microns. Show your work.

   a. An amoeba measures about 0.6 mm in diameter.
   b. A human hair measures 0.2 mm in diameter.
   c. A human red blood cell is 0.007 mm in diameter.

3. A one-celled organism called a paramecium is about 125 microns in length.

   a. Find the length of the paramecium in millimetres. Show your work.
   b. How many times as long as a paramecium is an amoeba? Explain.

4. If you were to arrange 400 of one type of bacteria end-to-end on a ruler, they would measure 1 cm.

   a. How many of this type of bacteria would you find in 1 mm? Explain.
   b. How long is one bacterium? Give your answer as a fraction of 1 mm.

Check your answers on pages 101 and 102 in the Appendix.

5. Copy and complete the following table that gives the lengths of several microscopic organisms.

Organism	Actual Length (mm)	Actual Length (microns)	Magnification Power	Magnified Length (mm)
Paramecium	0.3	300	20 X	$20 \times 0.3 = 6$
Amoeba	0.85		40 X	
Desmid		400		24
Xantidium	0.1		20 X	
Hexamita		12		1.2

Check your answers on page 102 in the Appendix.

You need vitamins and minerals in your daily diet, but you may be surprised at just how tiny the amounts actually are. Vitamins and minerals are often measured in **milligrams** (mg).

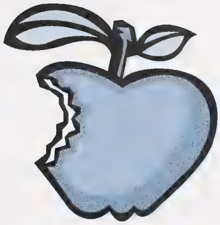
$$1 \text{ mg} = \frac{1}{1000} \text{ g} = 0.001 \text{ g}$$

To see how heavy 1 g is, hold a centicube or a small base ten cube in your hand. You can hardly feel it. Now imagine feeling one-thousandth of that mass!

6. How many milligrams are there in 1 g?

7. A medium orange contains about 50 mg of vitamin C. Express this mass in grams. Show your work.

8. A medium apple contains about 0.008 g of vitamin C. Express this mass in milligrams. Show your work.



Check your answers on page 102 in the Appendix.

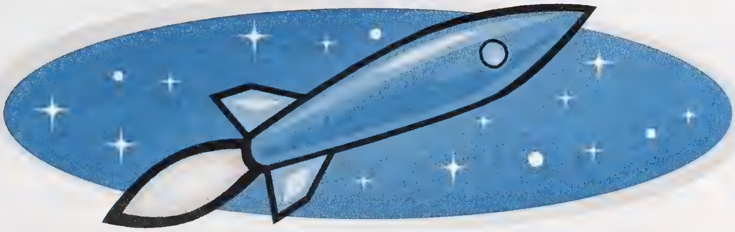
Sometimes the amount of a substance is so tiny that it is measured in **micrograms**.

$$1 \text{ microgram } (\mu g) = \frac{1}{1000} \text{ mg} = 0.001 \text{ mg}$$

9. **a.** How many micrograms are there in 1 mg?
   b. How many micrograms are there in 1 g? Explain.

10. A medium apple contains about 0.25 mg of iron. Express this mass in micrograms. Show your work.

11. Sometimes the microscopic world is referred to as **inner space**. Explain how the problem of measuring **inner space** is similar to the problem of measuring **outer space**. How is it different?



Check your answers on page 103 in the Appendix.

Sharing Time

Now it's time to show your home instructor what you have been learning.

Turn to page 18 of the Practice and Homework Book and complete questions 1 to 6.

Discuss your answers with your home instructor.

Challenge Activity

Chin Chin wrote down the wrong densities of the materials in her science report, as shown in the following table. Use the list of clues to help her rearrange the density numbers so that they are beside the correct materials. Explain your reasoning.

Clues

Note: Polystyrene foam is used to make disposable cups and some packing materials.

- Gold is heavier than lead.
- **Polystyrene** foam is lighter than balsa wood.
- Cork floats on water.
- Exactly three of the materials listed are lighter than water.
- Cork is about twice as dense as balsa wood.
- Silver is heavier than copper, but lighter than lead.
- Aluminum is lighter than copper.

Material	Density (g/cm^3)	
	Listed Value	Correct Value
Aluminum	0.035	
Balsa Wood	11.288	
Copper	10.491	
Cork	8.96	
Gold	0.112	
Lead	1.0	
Silver	19.32	
Polystyrene Foam	0.225	
Water	2.6989	

Check your answers on pages 103 and 104 in the Appendix.

Conclusion

In this lesson you saw how large numbers and small numbers are related. You used decimals to represent baseball batting averages and microscopic measurements. You represented decimals by using base ten blocks and place-value charts. You reviewed place value by reading, writing, comparing, ordering, and rounding decimals.

The bacteria above are too small to be seen without a microscope. The invention of the microscope allowed medical researchers to study and classify the micro-organisms that are responsible for disease. Did you know that it was Antonie van Leeuwenhoek (1632–1723) that pioneered the development of the light microscope?

If you have access to the Internet, you can find out more about the history of the microscope at the following website:

http://www.az-microscope.on.ca/history.html

Turn to Assignment Booklet 1A and complete the Lesson 2 Assignment.

When you are done, submit Assignment Booklet 1A to your teacher to be marked.

Lesson 3

Integers

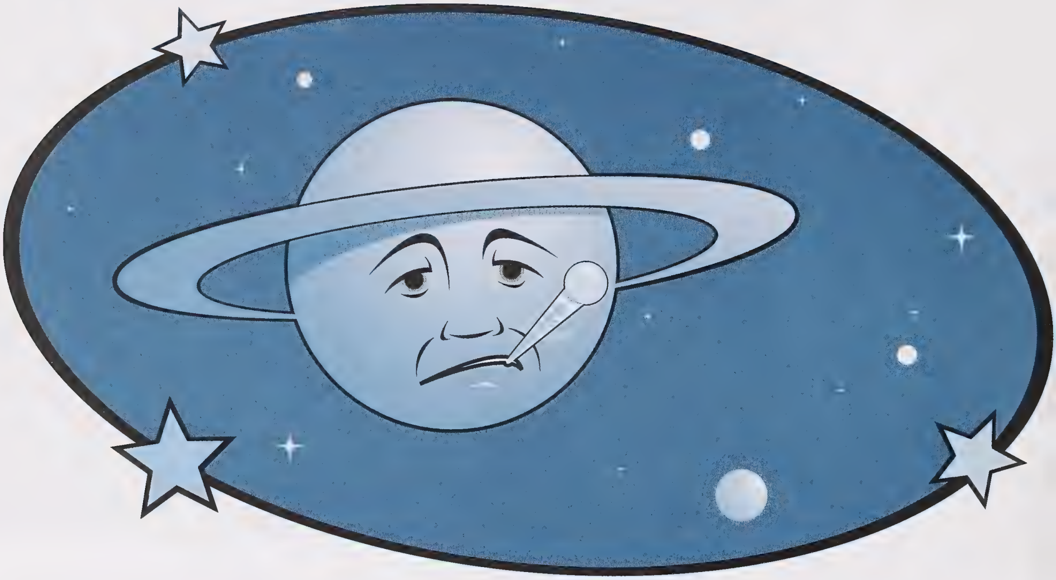
What do you think of when you look at the photograph of the dogteam on the snow and ice in Canada's arctic? Do you think of winter, cold winds, and snow? What do you think the temperature was when the picture was taken? 10°C? 0°C? −30°C?

If you think the temperatures on Earth are extreme, they are nothing compared to those on Mars. The average temperature on Mars is a chilly −55°C!

The numbers −55, −30, 0, and 10 are examples of **integers**. In this lesson you will be introduced to integers and see how they can be used to measure a variety of things, such as temperature and elevation.

Activity 1

Today you will explore how integers can be used to measure temperature.



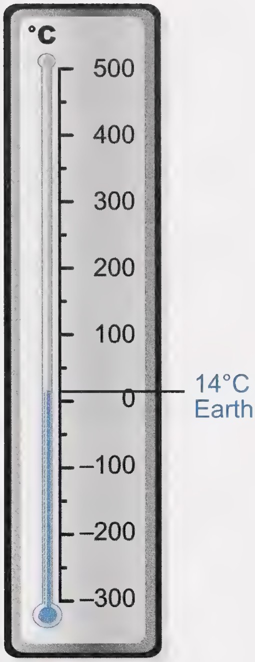
Integers are **positive** and **negative** whole numbers. Remember, positive integers are larger than zero and negative integers are less than zero. The Swedish scientist Anders Celsius (1701–1744) invented the Celsius temperature scale used today in most countries of the world.

If you have access to the Internet, you can find more about Anders Celsius at the following website:

http://www.astro.uu.se/history/Celsius_eng.html

On the Celsius temperature scale, water freezes at 0° and boils at 100°C. In outer space, temperatures can be extremely hot or extremely cold.

Imagine using a huge thermometer to take the temperatures of the planets. Earth's average surface temperature is marked and labelled on such a thermometer.



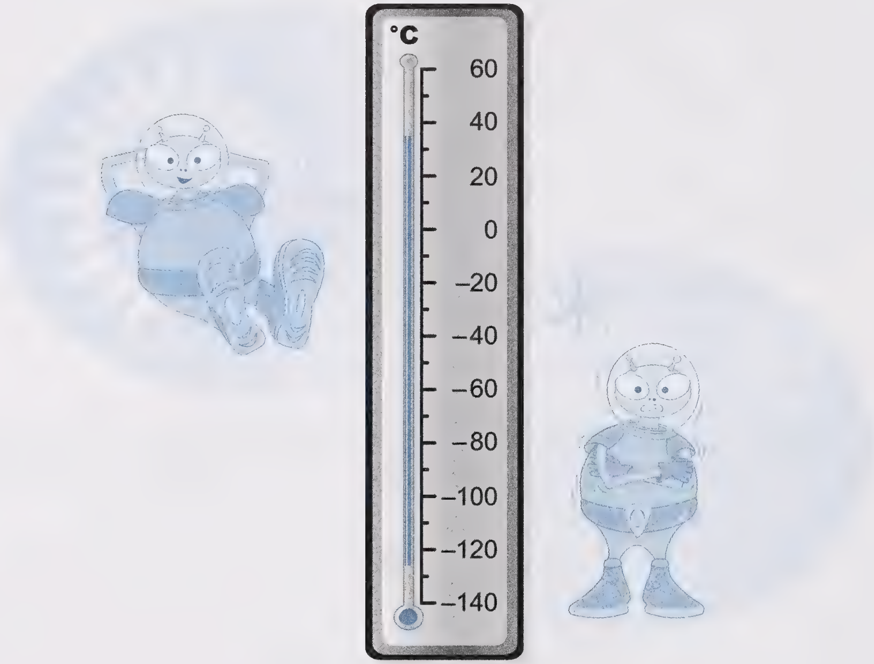
1. Copy the thermometer into your notebook. Then estimate, mark, and label the average surface temperatures of the other eight planets in the solar system.

Planet	Average Surface Temperature (°C)
Earth	14
Jupiter	–153
Mars	–55
Mercury	167
Neptune	–225
Pluto	–230
Saturn	–185
Uranus	–214
Venus	457

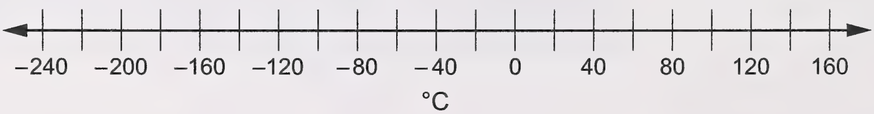
2. Half of Mercury always faces the sun, and its surface temperature stays at about $400°C$. The other side of the planet is always away from the sun, and it remains in darkness, where the temperature stays at about $-200°C$.

   In your notebook, draw a thermometer like the one you drew for question 1. Then shade (colour) in Mercury's range of temperatures.

3. The temperature range on Mars is shaded on the following thermometer. Find the greatest and the least temperatures.



4. You don't always need to draw a thermometer vertically to picture temperature. Often, a horizontal number line is used. The temperature on the moon ranges from $-233°C$ to $120°C$. Show this range of temperatures on a number line like the following.



5. Jupiter's moon, Io, has a mean surface temperature of $-143°C$. Saturn's moon, Titan, has a mean surface temperature of $-180°C$. Which of these moons has a warmer surface temperature? Explain.

6. Neptune's moon, Triton, has an extremely thin atmosphere. It is the coldest measured object in the solar system, with a temperature of $-235°C$. Neptune's average surface temperature is $-225°C$. By how many degrees is Triton colder than Neptune?

Check your answers on pages 104 and 105 in the Appendix.

Temperature measures the relative motion of the molecules that make up a substance. If there wasn't any motion, the temperature would be absolute zero, the coldest temperature possible.

Turn to page 137 in your textbook and read Absolutely the Coldest. Use the scales shown to answer questions 7 to 10.

7. Are there any negative integers on the Kelvin scale? Explain.

8. a. How does the size of one degree on the Celsius scale compare to the size of one degree on the Kelvin scale?

   b. How is a temperature on the Celsius scale related to a temperature on the Kelvin scale?

   c. How can you convert a temperature on the Celsius scale to a temperature on the Kelvin scale?

9. Find the following temperatures on the Kelvin scale.

   a. $20°C$
   b. $100°C$
   c. $-100°C$

10. Why do you think scientists decided to use the Kelvin scale?

Check your answers on pages 105 and 106 in the Appendix.

Activity 2

Today you will explore temperature and elevation as applications of integers.

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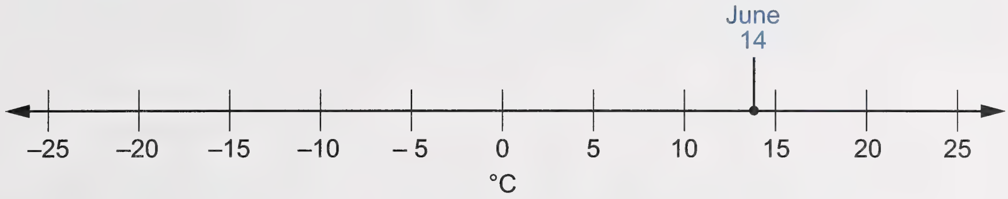
On of the most common uses of integers in everyday life is for temperature. The Celsius scale is used to represent everyday temperatures. Winter temperatures in Alberta are often colder than 0°C, so negative numbers are needed to measure them.

The following table shows the average monthly temperatures for Ft. McMurray, Alberta.

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Average Temperature (°C)	−20	−16	−9	2	10	14	17	15	9	3	−9	−17

1. The average temperature for June is shown on the following number line. Copy the number line and mark and label the temperatures for the other 11 months.



2. Use the number line you drew in question 1 to find the answers for the following questions.

   a. What is the range of average monthly temperatures in Ft. McMurray?

   b. How many degrees higher is the average temperature in June than the average temperature in December?

   c. How many degrees lower is the average temperature in November than the average temperature in March?

Check your answers on page 106 in the Appendix.

When comparing numbers and integers by size, you can use the following symbols:

< less than
> greater than

Example

Compare the integers -4 and $+5$.

- -4 is less than $+5$, or $-4 < +5$.
- $+5$ is greater than -4, or $+5 > -4$.

Example

List $+5$, -2, -6, and 0 from smallest to largest.

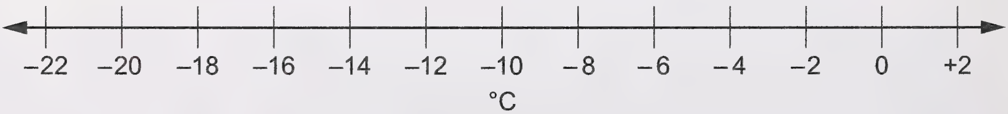
One solution is -6, -2, 0, $+5$. Another is to use the symbol <.

$$-6 < -2 < 0 < +5$$

3. The following table shows the average January temperatures for seven cities in Alberta. Write the temperatures in order, from least to greatest.

City	Average January Temperature (°C)
Calgary	−10
Edmonton	−14
Ft. McMurray	−20
Grande Prairie	−16
Lethbridge	−9
Medicine Hat	−11
Red Deer	−14

4. Use the table in question 3 and the following number line to find the answers for questions 4.a. to 4.c. Explain your reasoning.



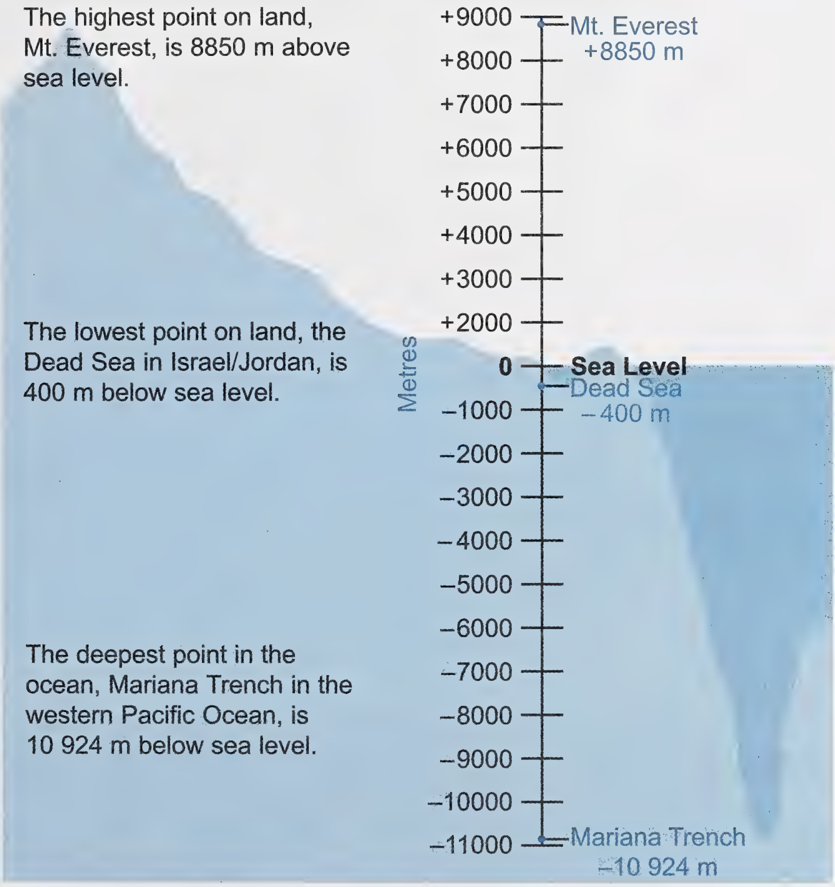
a. How much colder (°C) is the average January temperature in Grande Prairie than the average January temperature in Calgary?

b. How much warmer (°C) is the average January temperature in Medicine Hat than the average January temperature in Edmonton?

c. The average January temperature in which city is 5°C colder than the average January temperature in Lethbridge?

Check your answers on page 107 in the Appendix.

5. Integers are used to measure the elevation (height above sea level or depth below sea level) for points on land and in the oceans. Sea level has a value of 0 m. The following number line compares highest point on land, the lowest point on land, and the deepest point in the ocean.



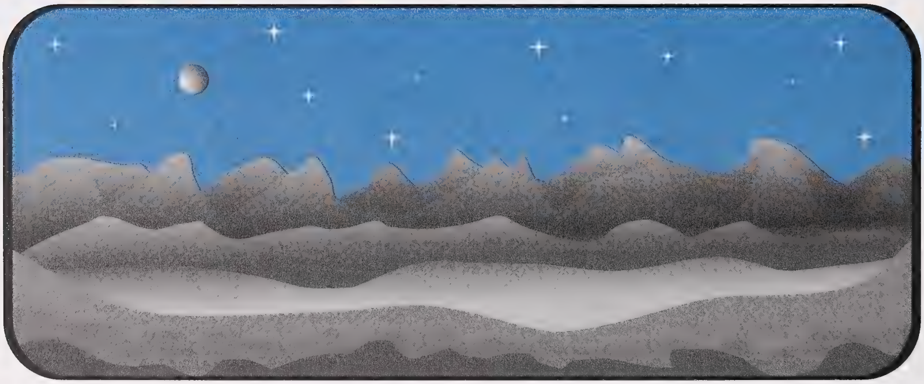
a. Which is the greater distance, the height of Mt. Everest above sea level, or the depth of the Mariana Trench below sea level? Tell how much greater.

b. Estimate the distance from the top of Mt. Everest to the bottom of the Mariana Trench.

6. The highest points on Earth are the tops of mountains. The lowest points are deep trenches in the oceans. The following tables show some of the world's highest mountains and some of the deepest trenches in the oceans. Give each of these places a positive or negative value and then mark and label them on the vertical number line on the previous page.

Name of Mountain	Location	Height (m)
Kilimanjaro	Tanzania	5895
Kosciusko	Australia	2228
Mont Blanc	France/Italy	4807
Puncak Jaya	Indonesia	5040
Columbia	Alberta/BC	3747
McKinley	Alaska	6194
Aconcagua	Argentina	6960

Name of Trench	Location	Depth (m)
Puerto Rico Trench	Atlantic Ocean	8648
Eurasia Basin	Arctic Ocean	5450
Java Trench	Indian Ocean	7125



7. Every place on Earth has a value (zero, positive, or negative) when compared to sea level. Some of these are shown in the following table. Write these places with their values, from least (deepest) to greatest (highest).

Place	Location	Height or Depth (m)
Lake Assal	Djibouti, Africa	−156
City of Victoria	British Columbia, Canada	+70
Mt. Nirvana	Northwest Territories, Canada	+2773
Mt. Caubvick	Newfoundland, Canada	+1622
Lake Eyre	Australia	−16
City of Calgary	Alberta, Canada	+1084
Cypress Hills	Saskatchewan, Canada	+1392
Death Valley	California, USA	−86
Bahia Blanca	Argentina	−40
City of Edmonton	Alberta, Canada	+671
Baldy Mountain	Manitoba, Canada	+832

Check your answers on pages 107 and 108 in the Appendix.

Sharing Time

Now it's time to show your home instructor what you have been learning.

Turn to page 59 of the Practice and Homework Book and complete questions 1 to 10.

Discuss your answers with your home instructor.

Activity 3

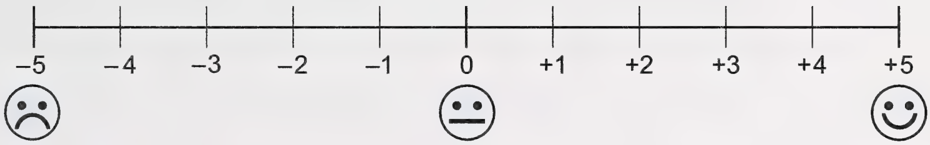
Today you will discover how integers can be used in **rating scales**.

Remember to finish your vegetables! You probably have some favourite vegetables that you prefer to eat more often than others, and some that you hope will never be on the menu.

1. a. List the five vegetables you prefer most in order, from most favourite to least favourite.

   b. List the five vegetables you dislike most in order, from your strongest dislike (you refuse to eat them) to your weakest dislike (you will eat them if you have to).

2. In your notebook, make a number line like the one that follows. Use it to answer questions 2.a. to 2.d.



   a. Which number would represent your favourite vegetable? Write its name above that number.

   b. Which number would represent the vegetable you dislike most? Write its name above that number.

   c. Write the names of the remaining vegetables above the numbers you choose for them.

   d. What feeling would describe your preference for a vegetable if you gave it a zero?

Check your answers on pages 108 and 109 in the Appendix.

Gabrielle's favourite vegetable is broccoli, but her twin sister, Shyler, dislikes it. Gabrielle polled the members of her soccer team to see how popular broccoli is among them. She made up her own scale and asked each member to check one of the choices.

I like broccoli.	+3	Broccoli is delicious. It's my favourite!
	+2	I enjoy broccoli quite a lot, but it's not my favourite vegetable.
	+1	I like broccoli, but I often prefer other vegetables.
	0	I neither like nor dislike broccoli.
I don't like broccoli.	−1	I don't like broccoli. I wouldn't choose it from a menu.
	−2	I really dislike broccoli, but it's not the worst.
	−3	I dislike broccoli more than any other vegetable!

3. The results of Gabrielle's survey are shown in the following table.

	I don't like broccoli.				**I like broccoli.**		
Rating	−3	−2	−1	0	+1	+2	+3
Number of People	2	3	4	3	1	3	4

a. Complete a line plot to display Gabrielle's results.

b. Shyler said Gabrielle's results show that broccoli is unpopular with the people surveyed, but Gabrielle disagreed with Shyler's conclusion. How might each of the girls justify her own interpretation of the results?

Check your answers on page 109 in the Appendix.

4. Some friends rated movies they saw over the summer. Show how you can use a number line to answer each of the following questions.

   a. Vic rated his most favourite movie as a $+9$. He rated his least favourite movie 12 numbers lower. What number did he use to rate his least favourite movie?

   b. Joe rated his least favourite movie as a -4. He rated his most favourite movie 11 numbers higher. What number did he use to rate his most favourite movie?

   c. Which of the two boys gave a lower rating to his least favourite movie? How much lower was the rating?

   d. Which boy gave a higher rating to his most favourite movie? How much higher was the rating?

   e. Alyce watched Joe's most favourite movie, but she rated it 5 numbers lower than Joe did. What was Alyce's rating of the movie?

   f. David watched Vic's least favourite movie, but he rated it 4 numbers higher than Vic did. What was David's rating of the movie?

5. Why are integers useful for rating scales?

Check your answers on pages 109 to 111 in the Appendix.

Challenge Activity

In golf, the player who takes the least total number of strokes wins. Each hole on the golf course has a par value that players try to beat. If you shoot par, then your score with respect to par is zero. If you take more strokes than par, you are shooting above par, and this is represented by a positive number. If you take fewer strokes than par, you are shooting below par, and this is represented by a negative number. So, golfers feel positive about being negative!

Tigger Woodrow played 9 holes of golf. She didn't start off too well, but on each succeeding hole, she took one fewer stroke. On the ninth hole, she shot a hole-in-one. Par for the different holes is shown in the following table.

Hole	1	2	3	4	5	6	7	8	9
Par	3	3	4	5	3	5	6	4	3

1. Find Tigger Woodrow's score for the game.

2. Use an integer to represent Tigger's score compared to par.

Check your answers on page 111 in the Appendix.

Conclusion

In this lesson you were introduced to integers and saw how they are used to measure things like temperature and elevation. You also explored their use for ratings in opinion polls.

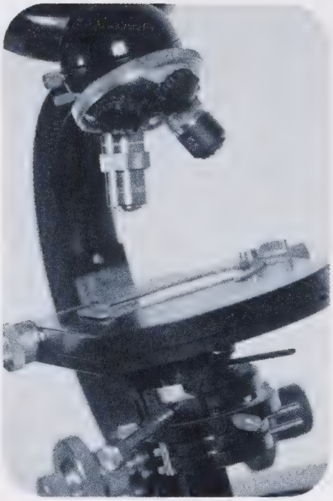
Did you know that mission control uses integers during a launch countdown? Before the rocket blasts off from the launch pad, the time before the launch is quoted as negative or “minus.” “T (time) minus 10” means there are ten seconds until ignition. Mission control refers to times after the launch as positive or “plus.” “T (time) plus 20” means 20 seconds after ignition.

Turn to Assignment Booklet 1B and complete the Lesson 3 Assignment.

Keep Assignment Booklet 1B until you have completed the entire booklet.

Module Summary

In Module 1 you saw how large whole numbers are used to describe distances in space, populations, and money and how decimals are used to represent batting averages and to measure microscopic objects. You extended your understanding of both large and small numbers by making models and by using place-value charts to represent them. You reviewed place value by reading, writing, comparing, ordering, and rounding numbers. You were introduced to integers and saw how they are used to measure things like temperature and elevation and to represent ratings in opinion polls.



Large and small numbers, decimal numerals, and integers are needed not only to describe the universe, but also to describe our own planet, Earth. Did you know that Earth is approximately 4.6 billion years old, is located 149 million kilometres from the sun, and has surface temperatures that range from below $-60°\text{C}$ at the poles to over $+40°\text{C}$ near the equator?

Turn to Assignment Booklet 1B and complete the Numbers in the News project.

When you are done, submit Assignment Booklet 1B to your teacher to be marked.

Keystrokes

Take out your calculator and complete the following exercises. They will help you review some of the ideas you have learned in Module 1.

Funky Feature: Elastic Numerals

This feature can be used to practise writing large whole numbers in expanded form. You can also use it to practise reading and writing any eight-digit whole number or decimal.

Example 1

To expand sixty-five million two hundred ninety-one thousand three hundred eighty-two, enter 60 000 000 [+] 5 000 000 [+] 200 000 [+] 90 000 [+] 1000 [+] 300 [+] 80 [+] 2 [=].

If you expanded it correctly, the calculator display will read 65 291 382.

Example 2

To expand eight hundred forty-six thousandths, enter 0.8 [+] 0.04 [+] 0.006 [=].

If you expanded it correctly, the calculator display will read 0.846.

1. Try expanding these large whole numbers.

   a. ninety-eight million four hundred sixty-five thousand two hundred eleven

   b. twenty-two million fifty thousand sixty-four

   c. ten million one hundred seventy

   d. fifteen million five hundred thousand five

2. Try expanding these decimal numbers.

   a. two hundred fourteen thousandths
   b. nine hundred two thousandths
   c. three hundred fifty thousandths
   d. six hundred sixteen ten thousandths

Check your answers on page 112 in the Appendix.

Funky Feature: Round It

You can round a number down on your calculator by subtracting.

Example

Round 42 835 to the nearest ten thousand.

Since the digit in the thousands place is less than 5, subtract the number formed by all the digits to the right of the ten thousands place.

4 2 8 3 5 Remember this number and subtract it.

Keystrokes	ON/C	42835	–	2835	=
Display	0	42835	42835	2835	40000

You can round a number up on your calculator by adding.

Example

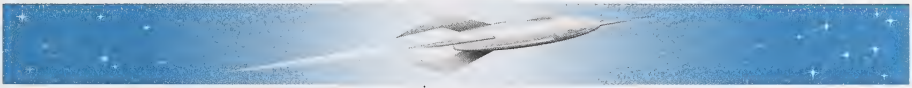
Round 46 835 to the nearest ten thousand.

Since the digit in the thousands place is 5 or greater, look at the number formed by all the digits to the right of the ten thousands place. Think of the number you would add to make it 9999, and then add 1.

4 6 8 3 5

3 1 6 4 + 1 = 3 1 6 5 Remember this number and add it.

Keystrokes	ON/C	46835	+	3165	=
Display	0	46835	46835	3165	50000



3. Round 5328 to the nearest thousand.

4. Round 5728 to the nearest thousand.

5. Round 29 328 to the nearest ten thousand.

6. Round 145 602 to the nearest ten thousand.

7. Round 236 094 to the nearest hundred thousand.

8. Round 276 094 to the nearest hundred thousand.

Check your answers on pages 112 and 113 in the Appendix.

Review

This Review will help you apply what you learned in Module 1 and prepare for the final test. Discuss with your home instructor when you should begin the Review and how much of the Review you should complete.

The following table lists the total areas (land and freshwater) of the Canadian provinces and territories. Use this data to answer questions 1 to 3.

Province or Territory	Total Area (km^2)
Alberta	661 848
British Columbia	944 735
Manitoba	647 797
New Brunswick	72 908
Newfoundland	405 212
Northwest Territories	1 346 106
Nova Scotia	55 284
Nunavut	2 093 190
Ontario	1 076 395
Prince Edward Island	5 660
Quebec	1 542 056
Saskatchewan	651 036
Yukon	482 443

1. Write the three greatest areas in words and as expanded numerals.

2. List the provinces and territories and their areas, from least to greatest, and round each area to its greatest place value.

3. Use your answers from question 2 to explain how to make the following estimates.

   a. How many times greater is the area of the largest province or territory than the area of the smallest province or territory?

   b. How many times greater is the area of Nunavut than the area of the Yukon?

   c. How many times greater is the area of Quebec than the area of New Brunswick?

   d. Which province or territory has an area about one-tenth the area of Alberta?

Check your answers on pages 113 to 115 in the Appendix.

If you need help with questions 1 to 3, look back at Lesson 1, where you learned about large numbers. If you feel you need more practice, do questions 4 through 7.

4. Turn to page 42 of your textbook. Do questions 1 and 2 of Practise Your Skills.

5. Turn to page 45 of your textbook. Do questions 1 to 7 of On Your Own.

6. Do questions 1 and 2 of Practise Your Skills on page 45 of your textbook. For question 2, round each number to the nearest hundred thousand.

7. Turn to page 58 of your textbook. Do questions 1 and 2 of Skill Bank from This Unit.

Check your answers on pages 115 and 116 in the Appendix.

Weight is the force of gravity, and it is measured in newtons (N). The following table shows how much an apple that weighs 1 N on Earth would weigh on the Moon and other planets in the solar system. Use the data given to answer questions 8 to 10.

Planet or Moon	Weight of Apple (N)
Mercury	0.378
Venus	0.907
Earth	1.000
Mars	0.377
Jupiter	2.364
Saturn	0.916
Uranus	0.889
Neptune	1.125
Pluto	0.067
Moon	0.166

8. Write in words and as an expanded numeral the weight (N) of the apple on each of the given planets.

    a. Mercury
    b. Jupiter
    c. Uranus

9. List the planets and the weights the apple would have on them in order, from least weight to greatest weight. Round each weight to the nearest hundredth.

10. Use your rounded answers from question 9 to explain how to make the following estimates.

    a. The apple would weigh how many times more on Venus than on Pluto?

b. On which planet would the apple weigh twice what it would weigh on Neptune?

c. On which planet would the apple weigh one-third what it would weigh on Neptune?

Check your answers on pages 116 and 117 to in the Appendix.

If you need help with questions 8 to 10, look back at Lesson 2, where you learned about decimals. If you feel you need more practice, do questions 11 and 12.

11. Turn to page 58 of your textbook. Do questions 3 and 4 of Skill Bank from This Unit.

12. Turn to page 59 of your textbook. Do questions 5 and 8 of Skill Bank Looking Back.

Check your answers on pages 117 and 118 in the Appendix.

Turn to page 136 of your textbook to Exploring Integers. Use the data given in Temperature Ranges of Canadian Cities to answer questions 13 and 14.

13. a. On each of the three charts (green, yellow, and pink), find the highest temperature. Give the city, the date, and the temperature.

b. On each of the three charts, find the lowest temperature. Give the city, the date, and the temperature.

14. Make a number line and use it to mark and label all the temperatures from your answers to question 13.

15. Turn to page 144 of your textbook. Do question 5 Skill Bank from This Unit.

Check your answers on page 118 in the Appendix.

If you need help with questions 13 to 15, look back at Lesson 3, where you learned about integers. If you feel you need more practice, do questions 16 to 18.

16. Turn to page 139 of your textbook.

- **a.** Do questions 1 and 2 of On Your Own.
- **b.** Do questions 1 to 6 of Practise Your Skills.

17. Turn to page 175 of your textbook. Do question 8 of Skill Bank Looking Back.

18. Turn to page 203 of your textbook. Do question 3 of Skill Bank Looking Back.

Check your answers on pages 118 and 119 in the Appendix.

19. Turn to pages 56 and 57 of your textbook. Do questions 1 to 5 of Problem Bank.

Check your answers on pages 120 and 121 in the Appendix.

If you need additional work to master the material in this module, work through the following lessons on the Mathematics 6 Companion CD.

Lesson 1: Decimals
Lesson 6: Understanding Integers
Lesson 9: Rounding Numbers

After each lesson, you can print out the solutions to the question in the activity by clicking on the Parent Notes button at the bottom of the screen. Discuss your answers with your home instructor.

Just the Facts

You may have forgotten some multiplication and division facts if you haven't practised for a while, but don't be discouraged—you will improve with regular practice. The amount of time you should spend practising will depend on how many of the facts you know. Make a set of flash cards using the following facts, mix them up, and try some every day. Set aside the facts you know well. Practise the facts that stump you.

$0 \times 0 =$	$0 \times 1 =$	$0 \times 2 =$	$0 \times 3 =$	$0 \times 4 =$	$0 \times 5 =$	$0 \times 6 =$	$0 \times 7 =$	$0 \times 8 =$	$0 \times 9 =$
$1 \times 0 =$	$1 \times 1 =$	$1 \times 2 =$	$1 \times 3 =$	$1 \times 4 =$	$1 \times 5 =$	$1 \times 6 =$	$1 \times 7 =$	$1 \times 8 =$	$1 \times 9 =$
$2 \times 0 =$	$2 \times 1 =$	$2 \times 2 =$	$2 \times 3 =$	$2 \times 4 =$	$2 \times 5 =$	$2 \times 6 =$	$2 \times 7 =$	$2 \times 8 =$	$2 \times 9 =$
$3 \times 0 =$	$3 \times 1 =$	$3 \times 2 =$	$3 \times 3 =$	$3 \times 4 =$	$3 \times 5 =$	$3 \times 6 =$	$3 \times 7 =$	$3 \times 8 =$	$3 \times 9 =$
$4 \times 0 =$	$4 \times 1 =$	$4 \times 2 =$	$4 \times 3 =$	$4 \times 4 =$	$4 \times 5 =$	$4 \times 6 =$	$4 \times 7 =$	$4 \times 8 =$	$4 \times 9 =$
$5 \times 0 =$	$5 \times 1 =$	$5 \times 2 =$	$5 \times 3 =$	$5 \times 4 =$	$5 \times 5 =$	$5 \times 6 =$	$5 \times 7 =$	$5 \times 8 =$	$5 \times 9 =$
$6 \times 0 =$	$6 \times 1 =$	$6 \times 2 =$	$6 \times 3 =$	$6 \times 4 =$	$6 \times 5 =$	$6 \times 6 =$	$6 \times 7 =$	$6 \times 8 =$	$6 \times 9 =$
$7 \times 0 =$	$7 \times 1 =$	$7 \times 2 =$	$7 \times 3 =$	$7 \times 4 =$	$7 \times 5 =$	$7 \times 6 =$	$7 \times 7 =$	$7 \times 8 =$	$7 \times 9 =$
$8 \times 0 =$	$8 \times 1 =$	$8 \times 2 =$	$8 \times 3 =$	$8 \times 4 =$	$8 \times 5 =$	$8 \times 6 =$	$8 \times 7 =$	$8 \times 8 =$	$8 \times 9 =$
$9 \times 0 =$	$9 \times 1 =$	$9 \times 2 =$	$9 \times 3 =$	$9 \times 4 =$	$9 \times 5 =$	$9 \times 6 =$	$9 \times 7 =$	$9 \times 8 =$	$9 \times 9 =$

$0 \div 1 =$	$0 \div 2 =$	$0 \div 3 =$	$0 \div 4 =$	$0 \div 5 =$	$0 \div 6 =$	$0 \div 7 =$	$0 \div 8 =$	$0 \div 9 =$
$1 \div 1 =$	$2 \div 2 =$	$3 \div 3 =$	$4 \div 4 =$	$5 \div 5 =$	$6 \div 6 =$	$7 \div 7 =$	$8 \div 8 =$	$9 \div 9 =$
$2 \div 1 =$	$4 \div 2 =$	$6 \div 3 =$	$8 \div 4 =$	$10 \div 5 =$	$12 \div 6 =$	$14 \div 7 =$	$16 \div 8 =$	$18 \div 9 =$
$3 \div 1 =$	$6 \div 2 =$	$9 \div 3 =$	$12 \div 4 =$	$15 \div 5 =$	$18 \div 6 =$	$21 \div 7 =$	$24 \div 8 =$	$27 \div 9 =$
$4 \div 1 =$	$8 \div 2 =$	$12 \div 3 =$	$16 \div 4 =$	$20 \div 5 =$	$24 \div 6 =$	$28 \div 7 =$	$32 \div 8 =$	$36 \div 9 =$
$5 \div 1 =$	$10 \div 2 =$	$15 \div 3 =$	$20 \div 4 =$	$25 \div 5 =$	$30 \div 6 =$	$35 \div 7 =$	$40 \div 8 =$	$45 \div 9 =$
$6 \div 1 =$	$12 \div 2 =$	$18 \div 3 =$	$24 \div 4 =$	$30 \div 5 =$	$36 \div 6 =$	$42 \div 7 =$	$48 \div 8 =$	$54 \div 9 =$
$7 \div 1 =$	$14 \div 2 =$	$21 \div 3 =$	$28 \div 4 =$	$35 \div 5 =$	$42 \div 6 =$	$49 \div 7 =$	$56 \div 8 =$	$63 \div 9 =$
$8 \div 1 =$	$16 \div 2 =$	$24 \div 3 =$	$32 \div 4 =$	$40 \div 5 =$	$48 \div 6 =$	$56 \div 7 =$	$64 \div 8 =$	$72 \div 9 =$
$9 \div 1 =$	$18 \div 2 =$	$27 \div 3 =$	$36 \div 4 =$	$45 \div 5 =$	$54 \div 6 =$	$63 \div 7 =$	$72 \div 8 =$	$81 \div 9 =$

Turn to the Just the Facts Progress Chart in the Appendix. Remove the chart from the Appendix and hang it in your study area. You will use this chart to record your scores as you complete each Just the Facts activity.

Ask your home instructor to time you as you complete the following timed drill. Your goal is to complete all 25 questions in two minutes. At the end of two minutes, count how many questions you were able to complete. Then use the Answer Key in the Appendix to mark the drill, and record your score in the space provided. Before you move on, go back and complete any questions you did not finish.

Multiplication and Division Facts

$0 \times 0 =$	$0 \div 1 =$	$\begin{array}{r} 9 \\ \times\ 0 \\ \hline \end{array}$	$9\overline{)9}$	$1 \times 1 =$
$6 \div 3 =$	$\begin{array}{r} 7 \\ \times\ 2 \\ \hline \end{array}$	$7\overline{)21}$	$3 \times 3 =$	$20 \div 5 =$
$\begin{array}{r} 5 \\ \times\ 4 \\ \hline \end{array}$	$5\overline{)25}$	$5 \times 5 =$	$42 \div 7 =$	$\begin{array}{r} 3 \\ \times\ 6 \\ \hline \end{array}$
$3\overline{)21}$	$7 \times 7 =$	$72 \div 9 =$	$\begin{array}{r} 1 \\ \times\ 8 \\ \hline \end{array}$	$1\overline{)9}$
$9 \times 9 =$	$8 \div 2 =$	$\begin{array}{r} 2 \\ \times\ 4 \\ \hline \end{array}$	$6\overline{)6}$	$6 \times 8 =$

Multiplication and Division Facts

Number completed in 2 minutes: ______
Number correct in 2 minutes: ______

Record your score on the Just the Facts Progress Chart.

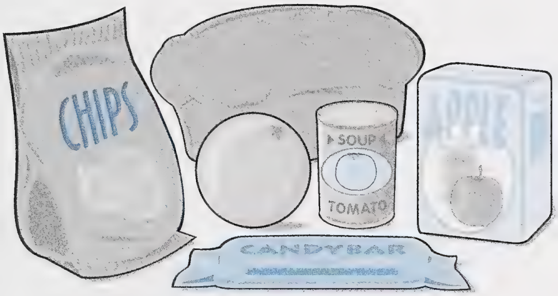
Mental Math

You probably do math "in your head" differently than when you use pencil and paper. There are many helpful mental-computation strategies you can learn and use. The strategies are named to describe what they do, and this makes them easier to think of when you need them.

The following example shows how you can combine the front-end and compensation estimation strategies to make an appropriate estimate.

Example

Suppose you are at the express checkout at the grocery store with 6 items. You have \$5. You wonder if you have enough money for the items you wish to buy: bread for $\$1.19$, juice for $\$0.99$, soup for $\$0.79$, grapefruit for $\$1.25$, a chocolate bar for $\$0.59$, and chips for $\$0.49$.



Front-End Estimation

Use the first digit (highest place value) of each number. You can see that this method will always give you a **low** estimate because you "cut off" the remaining digits.

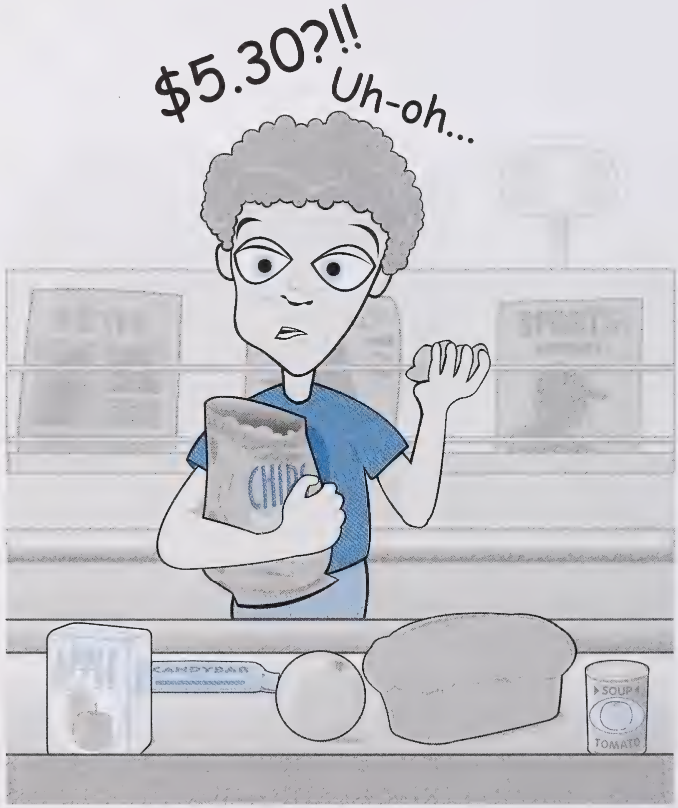
The front-end estimation strategy looks only at the whole dollar amounts, so you would get $\$1 + \$0 + \$0 + \$1 + \$0 + \$0 = \$2$. You know your total is much greater than $\$2$ because you ignored the cents, so you should use the compensation strategy to adjust your estimate to get a more accurate total.

Compensation

Use this strategy to help you adjust your front-end estimate. You might think that $0.99 is about $1, $0.79 + $0.25 is about $1, and $0.59 + $0.49 is about $1. That makes another $3. There is still $0.19 to add, so your total will be close to but greater than $5.

This gives you a chance to put the chips back before the cashier rings up your exact total. The total for the 6 items is $5.30. The total without the chips is $4.81.

Try to practise these strategies whenever it is appropriate to use them.



Mathematics 6

Appendix

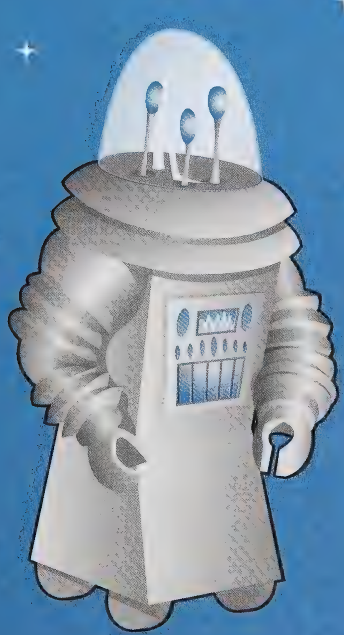
Glossary

Answer Key

Image Credits

Just the Facts

Progress Chart



Glossary

astronomical unit: the distance from Earth to the sun, approximately 150 million kilometres

expanded form: the form that shows the place values of the digits of a numeral

integer: a positive or negative whole number or a zero

light-year: the distance travelled by light in one year

micron: one-thousandth of a millimetre

microgram: one-thousandth of a milligram

milligram: one-thousandth of a gram

negative: less than zero

parsec: approximately 3.26 light-years

place value: in a numeral, the value of a digit determined by its position to the left or right of the one's digit

positive: greater than zero

rating scale: a scale used to indicate like or dislike

standard form: the decimal numeral form in which numbers are usually written

triad: a group of three digits

Answer Key

Lesson 1: Understanding Large Numbers

Activity 1

1.

Planet	Distance from the Sun (millions of km)	Distance from the Sun (km)
Mercury	58	58 000 000
Venus	108	108 000 000
Earth	150	150 000 000
Mars	228	228 000 000
Jupiter	778	778 000 000
Saturn	1429	1 429 000 000
Uranus	2871	2 871 000 000
Neptune	4504	4 504 000 000
Pluto	5913	5 913 000 000

2. **a.** Uranus is about two times farther from the sun than Saturn is. Saturn is about 1400 million kilometres (1 billion 400 million kilometres) from the sun, and Uranus is about 2800 million kilometres (2 billion 800 million kilometres) from the sun $(2 \times 1400 = 2800)$.

   b. Pluto is about 100 times further from the sun than Mercury is. Mercury is about 60 million kilometres from the sun, and Pluto is about 6000 million kilometres (6 billion kilometres) from the sun $(100 \times 60 = 6000)$.

   c. Uranus is about 4 times farther from the sun than Jupiter is. Jupiter is about 700 million kilometres from the sun, and Uranus is about 2800 million kilometres (2 billion 800 million kilometres) from the sun $(4 \times 700 = 2800)$.

d. Neptune is about 20 times farther from the sun than Mars is. Mars is about 220 million kilometres from the sun, and Neptune is about 4400 million kilometres (4 billion 400 million kilometres) from the sun $(20 \times 220 = 4400)$.

e. Neptune is about 30 times farther from the sun than Earth is. Earth is about 150 million kilometres from the sun, and Neptune is about 4500 million kilometres (4 billion 500 million kilometres) from the sun $(30 \times 150 = 4500)$.

3. a. Mercury is fifty-eight million kilometres from the sun.
   b. Earth is one hundred fifty million kilometres from the sun.
   c. Pluto is five billion nine hundred thirteen million kilometres from the sun.

4. a. The planets listed in order, from least to greatest diameter, are Pluto, Mercury, Mars, Venus, Earth, Neptune, Uranus, Saturn, and Jupiter.

   b. Jupiter has the greatest diameter. It is one hundred forty-two thousand eight hundred kilometres.

   c. Pluto has the least diameter. It is two thousand three hundred kilometres.

   d. Jupiter's diameter is about one-tenth of the sun's diameter. Jupiter's diameter is about 140 000 km, and the sun's diameter is about 1 400 000 km $(10 \times 140\,000 = 1\,400\,000)$.

   e. Earth and Venus are closest in diameter: $12\,756 \text{ km} - 12\,104 \text{ km} = 652 \text{ km}$.
   The next closest pair is Mars and Mercury: $6787 \text{ km} - 4878 \text{ km} = 1909 \text{ km}$.

   f. Saturn's diameter is about ten times greater than Venus's diameter. Saturn's diameter is 120 000 km, and Venus's diameter is about 12 000 km $(10 \times 12\,000 = 120\,000)$.

   g. Pluto's diameter is about half of the size of Mercury's diameter. Pluto's diameter is 2300 km, and Mercury's diameter is about 4600 km $(2 \times 2300 = 4600)$.

5. **a.** The distance between Earth and the sun is about 1 million times greater than the distance from Red Deer to Edmonton or Calgary.

   b. It would take you 1.5 h to drive from Red Deer to Calgary. It would take 1 h to drive 100 km. It would take 0.5 h to drive 50 km, so 150 km would take 1.5 h.

   c. It would take about 171 years to drive to the sun at 100 km/h.

   - Each 100 km would take 1 h, so 150 000 000 km would take $150\,000\,000 \text{ km} \div 100 \text{ km/h} = 1\,500\,000 \text{ h}$.

   - $1\,500\,000 \text{ h} \div 24 \text{ h/day} = 62\,500 \text{ days}$

   - $62\,500 \text{ days} \div 365 \text{ days/year}$ is a little more than 171 years.

6. **a.** Mercury's diameter of 4878 km is closest to this distance.

   b. You would have to make about 70 trips across Canada to travel the distance to the moon.

   $384\,321 \div 5514 \doteq 69.699$, which is between 69 and 70.

7. Distances in Alberta and Canada seem very tiny when compared to distances in space.

8. Your model should look similar to the following.

Activity 2

1. a. You would need 100 rows of centicubes. The edge of the cube is 100 cm and the edge of each centicube is 1 cm.

   b. You should put 100 centicubes in each row. The edge of the cube is 100 cm and the edge of each centicube is 1 cm.

   c. You would need 10 000 centicubes for the whole layer.

   $$100 \text{ rows} \times 100 \text{ centicubes in each row} = 10\,000 \text{ centicubes}$$

2. a. You would need 100 layers to make a 1-m^3 cube. The edge of the cube is 100 cm and the edge of each centicube is 1 cm.

   b. You would need 1 000 000 centicubes to make a 1-m^3 cube.

   $$100 \text{ layers} \times 10\,000 \text{ centicubes in each layer} = 1\,000\,000 \text{ centicubes}$$

3. If Nina were able to work non-stop, it would take her almost two weeks to do it.

   $1\,000\,000 \text{ s} \div 60 \text{ s/min}$ is about 16 667 min.

   $16\,667 \text{ min} \div 60 \text{ min/h}$ is about 278 h.

   $278 \text{ h} \div 24 \text{ h/d}$ is about 11.5 d.

4. a. Ten thousand centicubes on each face would have some paint on them.

   $$100 \text{ rows} \times 100 \text{ centicubes in each row} = 10\,000 \text{ centicubes}$$

   b. About 60 000 centicubes in the entire cube would have some paint on them.

   $$6 \text{ faces} \times 10\,000 \text{ centicubes visible on each face} = 60\,000 \text{ centicubes}$$

c. One layer would be removed from each face of the cube. Each dimension would be reduced by 2 cm. Because $100 \text{ cm} - 2 \text{ cm} = 98 \text{ cm}$, the cube is 98 cm on each side.

d. Exactly 941 192 centicubes would have no paint on them.

$$98 \times 98 \times 98 = 941\,192$$

e. Exactly 58 808 centicubes would have some paint on them.

$$1\,000\,000 - 941\,192 = 58\,808$$

f. The answers to questions 4.b. and 4.e. are close. 58 808 is approximately 60 000. They differ by only 1192, which is small when compared to 60 000.

5. a.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
●●●●	●●●	●●●●● ●●●	●	●●●●●	●●●●● ●	●●	●●	●●●●● ●●●●

Expanded Numeral: $400\,000\,000 + 30\,000\,000 + 8\,000\,000 + 100\,000 + 50\,000 + 6000 + 200 + 20 + 9$

Number Written in Words: four hundred thirty-eight million one hundred fifty-six thousand two hundred twenty-nine

b.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands
●●●●●	●●●●● ●●●●		●●●	●●●●	●

Hundreds	Tens	Ones
●●●●● ●●	●●●●● ●●●	●●●

Expanded Numeral: 500 000 000 + 90 000 000 + 300 000 + 40 000 + 1000 + 700 + 80 + 3

Number Written in Words: five hundred ninety million three hundred forty-one thousand seven hundred eighty-three

c.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands
●●●●● ●●●●	●●●	●●●●●	●●●●	●	●●

Hundreds	Tens	Ones
	●●●●● ●●	●●●●● ●●●

Expanded Numeral: 900 000 000 + 30 000 000 + 5 000 000 + 400 000 + 10 000 + 2000 + 70 + 8

Number Written in Words: nine hundred thirty-five million four hundred twelve thousand seventy-eight

6. a.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands
●●●●		●●●	●	●	

Hundreds	Tens	Ones
●●●●●		●●

Number written in standard form: 403 110 502

b.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands
●●●●	●	●●●●	●●●●● ●●●	●●●	●●●

Hundreds	Tens	Ones
●●●●	●●●●● ●●●●	●

Number written in standard form: 214 833 491

c.

Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
● ●	●	● ●	● ● ●	●			●	

Number written in standard form: 202 310 010

Activity 3

1. a. The mountain bike is the least expensive item. It costs $750.
   b. The yacht is the most expensive item. It costs $1 750 000.

2. a. You could not afford the yacht. It costs almost $2 million.

   b. Answers will vary. Sample answers are given.

   If you bought the luxury home, you would have $1 000 000 – $900 000 = $100 000 left to spend. You could also buy the following items:

Season ticket to the ballet	1 000
Sailboat	19 000
Recreational vehicle	55 000
Minivan	25 000
Total	$100 000

OR

Caribbean trip	3 000
Speedboat	34 000
Luxury car	63 000
Total	$100 000

OR

Diamond watch	24 000
Sports car	32 000
Cruise	8 000
New clothes	2 000
Swimming pool	11 000
Sailboat	19 000
Season ticket to the ballet	1 000
Caribbean trip	3 000
Total	$100 000

c. The least number of items you could buy from the list is four.

Luxury home	900 000
Caribbean trip	3 000
Speedboat	34 000
Luxury car	63 000
Total	$1 000 000

d. You could spend exactly $1 million if you bought the following items:

- 5 year-round homes
- 1000 season tickets to the ballet
- 8 vacation homes
- 500 trips to the World Series
- 40 minivans
- 125 cruises
- 500 sets of new clothes

3. a. Steven Spielberg's earnings are between 10 and 11 times greater than Doug Gilmour's.

b. Michael Eisner's earnings are about 13 times greater than Whitney Houston's.

c. Jack Nicholson earned close to $\frac{1}{1000}$ of the estimated worth of William Gates.

$$\text{Gates' worth} \div 1000 = \$120\ 00\ 000$$

d. You could not earn the estimated worth of Taikichiro Mori in your lifetime even if you earned $10 000 000 per year. If you worked for 100 years, you could earn $1 000 000 000 ($1 billion), and that is only $\frac{1}{18}$ of Taikichiro Mori's estimated worth.

4. a. The population of Alberta is about 3 000 000.
The population of Canada is about 30 000 000.
The population of Earth is about 6 000 000 000.

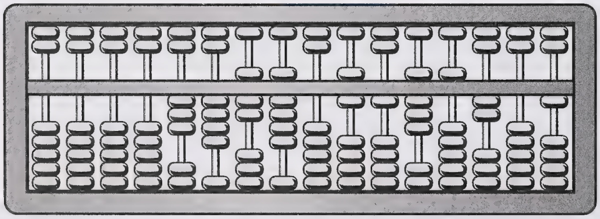
b. The population of Canada is about 10 times greater than the population of Alberta. $(30\ 000\ 000 \div 3\ 000\ 000 = 10)$

c. The population of Earth is about 200 times greater than the population of Canada. $(6\ 000\ 000\ 000 \div 30\ 000\ 000 = 200)$

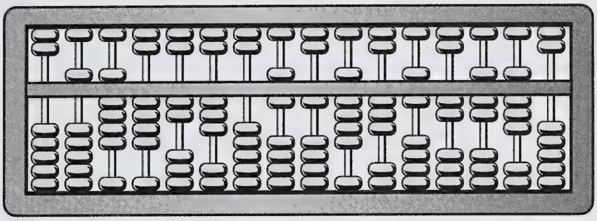
5. One million is 1000 times greater than 1000, and 1 000 000 000 is 1000 times greater than 1 000 000. This means that 1 000 000 000 is 1 000 000 times greater than 1000.

Challenge Activity

1. 347 906 185 201



2. 594 230 619 362 780



Lesson 2: Making Sense of Small Numbers

Activity 1

1.

Planet	Distance from Sun (AU)	Distance from Sun (AU) in Words
Mercury	0.387	three hundred eighty-seven thousandths
Venus	0.723	seven hundred twenty-three thousandths
Earth	1	one
Mars	1.524	one and five hundred twenty-four thousandths
Jupiter	5.203	five and two hundred three thousandths
Saturn	9.516	nine and five hundred sixteen thousandths
Uranus	19.157	nineteen and one hundred fifty-seven thousandths
Neptune	30.002	thirty and two thousandths
Pluto	39.470	thirty-nine and four hundred seventy thousandths

2. a. two hundred ninety-nine million seven hundred ninety-two thousand four hundred fifty-eight metres per second

   b. 299 792.458 km/s

   c. 300 000 km/s

3. a. It would take about 8 min to travel to the sun.

$$150\ 000\ 000\ \text{km} \div 300\ 000\ \text{km/s} = 500\ \text{s}$$
$$500\ \text{s} \div 60\ \text{s/min} = \text{a little more than } 8\ \text{min}$$

b. It would take about 1.3 seconds to travel to the moon.

$$384\ 321 \text{ km} \div 300\ 000 \text{ km/s} \doteq 1.3 \text{ seconds}$$

4. a. The distances in light-years, from least to greatest, are 4.22, 4.3, 4.35, 5.98, 8.43, 8.64, 25, 34, 41, 69, and 520.

b. Arcturus is about 0.5 of the distance that Achernar is from Earth. This means Achernar is about twice as far from Earth as Arcturus is.

- Arcturus is 34 light-years from Earth.
- 2×34 light-years $= 68$ light-years, and Achernar is 69 light-years from Earth.

c. Rigel Kentaurus is about 0.5 of the distance that Sirius is from Earth. This means Sirius is about twice as far from Earth as Rigel Kentaurus is.

- Rigel Kentaurus is 4.3 light-years from Earth.
- 2×4.3 light-years $= 8.6$ light-years, and Sirius is 8.64 light-years from Earth.

d. Vega is about $\frac{1}{20}$ of the distance that Betelgeuse is from Earth. This means that Betelgeuse is about twice as far from Earth as Vega is.

- Vega is 25 light-years from Earth.
- 20×25 light-years $= 500$ light-years, and Betelgeuse is 520 light-years from Earth.

5. An astronomical unit is $\frac{1}{206\ 265}$ of a parsec.

6. Compared to the size of the universe, a parsec is a small distance because you need millions of them to measure distances in the universe.

Activity 2

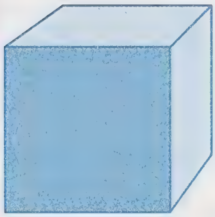
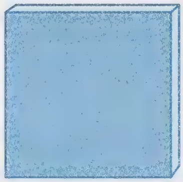
1. Ty Cobb has the greatest batting average of three hundred sixty-six (thousandths).

2. Spud Davis has the least batting average of three hundred eight (thousandths).

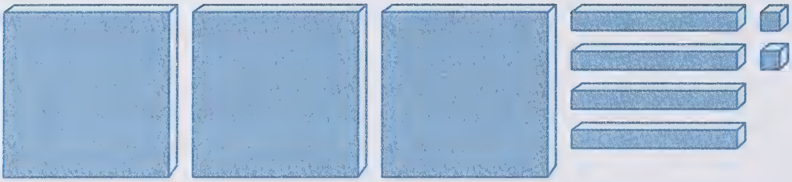
3. The batting averages, from greatest to least, are 0.366, 0.356, 0.344, 0.342, 0.340, 0.336, 0.325, 0.313, 0.311, and 0.308.

4. You should agree with Ted Williams. If a baseball player fails seven times out of ten attempts, then that player succeeds three times out of ten attempts. This gives a batting average of $\frac{3}{10} = \frac{300}{1000} = 0.300$, which is very close to the all-time averages listed in the table.

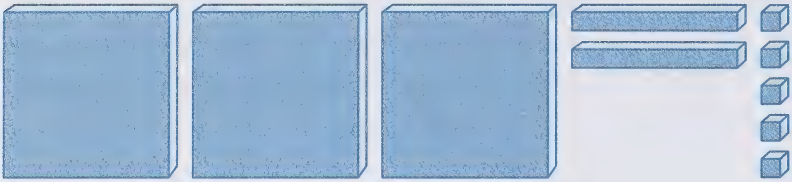
5.

Name	**Large Cube**	**Flat**	**Rod**	**Small Cube**
Picture				
Number of Hits Represented	1000	100	10	1
Batting Average as a Fraction	$\frac{1000}{1000}$	$\frac{100}{1000}$	$\frac{10}{1000}$	$\frac{1}{1000}$
Batting Average as a Decimal	1.000	0.100	0.010	0.001

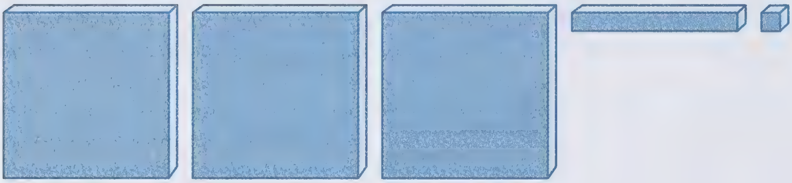
6. a. Babe Ruth: 0.342



b. Joe DiMaggio: 0.325

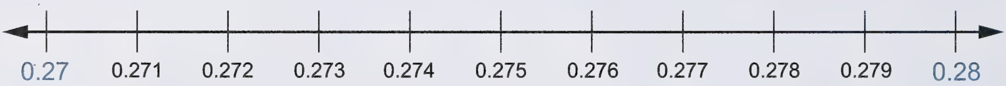


c. Jackie Robinson: 0.311

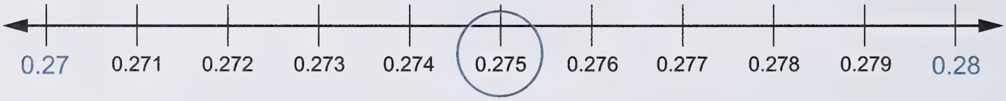


7. The difference between 0.27 and 0.28 is one-hundredth.

8.



9.



two hundred seventy-five thousandths

10. If a number is less than halfway between 0.27 and 0.28, you would round it to 0.27, and if a number is halfway or more between 0.27 and 0.28, you would round it to 0.28. Since 0.273 333 3 is less than halfway between 0.27 and 0.28, you would round it to 0.27.

11. Since 0.275 is exactly halfway between 0.27 and 0.28, you would round it to 0.28. The digits in the thousandths place tells you to raise the digit in the hundredths place.

12.

Name	Batting Average	Batting Average (Rounded)
Rogers Hornsby	0.358	0.36
Billy Hamilton	0.344	0.34
Harry Heilmann	0.342	0.34
George Sisler	0.340	0.34
Heinie Manush	0.329	0.33
Rod Carew	0.328	0.33
Jimmie Foxx	0.325	0.33
Hugh Duffy	0.324	0.32
Ken Williams	0.319	0.32
Goose Goslin	0.316	0.32

13. If you knew that a baseball player had made 298 hits in exactly 1000 times at bat, you shouldn't need to use a calculator because it is already expressed in thousandths. The batting average would be $\frac{298}{1000} = 0.298$.

Activity 3

1. $1 \text{ micron} = \frac{1}{1000} \text{ mm} = 0.001 \text{ mm}$

2. a. Its diameter is 600 microns.

$$1000 \text{ microns/mm} \times 0.6 \text{ mm} = 600 \text{ microns}$$

b. Its diameter is 200 microns.

$$1000 \text{ microns/mm} \times 0.2 \text{ mm} = 200 \text{ microns}$$

c. Its diameter is 7 microns.

$$1000 \text{ microns/mm} \times 0.007 \text{ mm} = 7 \text{ microns}$$

3. a. Its length is 0.125 mm.

$$125 \text{ microns} \div 1000 \text{ microns/mm} = 0.125 \text{ mm}$$

b. The amoeba is about 5 times longer than the paramecium.

$5 \times 0.125 = 0.625$ mm, and the paramecium is 0.6 mm.

4. a. You would find about 40 of this type of bacteria in 1 mm.

1 mm is $\frac{1}{10}$ of 1 cm, and $400 \div 10 = 40$

b. It is $\frac{1}{40}$ of 1 mm.

5.

Organism	Actual Length (mm)	Actual Length (microns)	Magnification Power	Magnified Length (mm)
Paramecium	0.30	300	20 X	6
Amoeba	0.85	850	40 X	$40 \times 0.85 = 34$
Desmid	0.4	400	60 X	24
Xantidium	0.1	100	20 X	$20 \times 0.1 = 2$
Hexamita	0.012	12	100 X	1.2

6. There are 1000 mg in 1 g.

7. $50 \text{ mg} = 0.05 \text{ g}$ $\quad$ $50 \text{ mg} = \frac{50}{1000} \text{ g} = 0.050 \text{ g}$

8. $0.008 \text{ g} = 8 \text{ mg}$ $\quad$ $0.008 \text{ g} = \frac{8}{1000} \text{ g} = 8 \text{ mg}$

9. a. There are 1000 μg in 1 mg.

b. There are 1 000 000 μg in 1 g because $1 \text{ g} = 1000 \text{ mg}$.

$$1000 \times 1000 = 1\,000\,000$$

10. $0.25 \text{ mg} = 250 \ \mu g$

$0.25 \text{ mg} = \frac{250}{1000} \text{ mg} = 250 \ \mu g$

11. Measurement of inner space is similar to the measurement of outer space because everyday units are not useful. It is different because you need very large units to measure distance and size in outer space, and you need very small units to measure distance and size in inner space.

Challenge Activity

Material	Density (g/cm^3)	
	Listed Value	Correct Value
Aluminum	0.035	2.6989
Balsa Wood	11.288	0.112
Copper	10.491	8.96
Cork	8.96	0.225
Gold	0.112	19.32
Lead	1.0	11.288
Silver	19.32	10.491
Polystyrene Foam	0.225	0.035
Water	2.6989	1.0

The densities in order, from least to greatest, are 0.035, 0.112, 0.225, 1.0, 2.6989, 8.96, 10.491, 11.288, and 19.32.

- Exactly three of the materials listed are lighter than water. (1.0 g/cm^3 is the fourth lightest density, so that must be the density of water.)

- Cork floats on water. (Cork is less dense than water, so its density must be one of the three that are less than 1.0 g/cm^3.)

- Cork is about twice as dense as balsa wood. (Of the three materials lighter than water, find the pair in which one material has twice the density of the other. The density of cork is 0.225 g/cm^3 and the density of balsa wood is 0.112 g/cm^3.)

- Polystyrene foam is lighter than balsa wood. (The density of Polystyrene foam is 0.225 g/cm^3.)

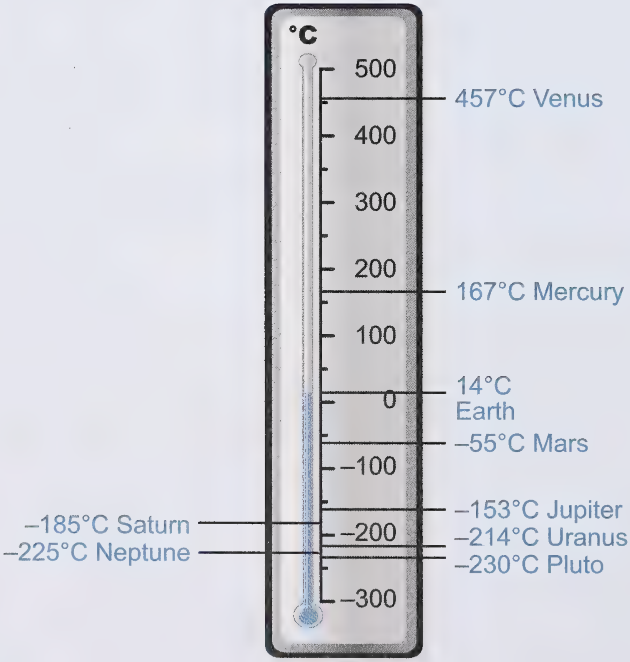
- Silver is heavier than copper, but lighter than lead. (These three metals from lightest to heaviest are copper, silver, and lead.)

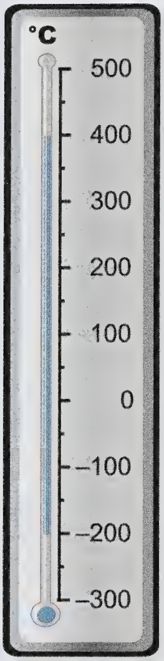
- Gold is heavier than lead and aluminum is lighter than copper. (The five metals from lightest to heaviest are aluminum, copper, silver, lead, and gold. Match them, in order, with the five highest densities: 2.6989, 8.96, 10.491, 11.288, and 19.32.)

Lesson 3: Integers

Activity 1

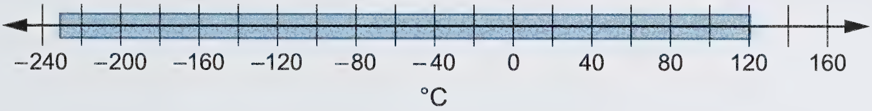
1.



2. 

3. The greatest temperature on Mars is $35°C$ and the least temperature is $-125°C$.

4. The temperature range on the moon is highlighted on the following number line.



5. Io has a warmer surface temperature than Titan. On a thermometer, Io's temperature of $-143°C$ is above Titan's temperature of $-180°C$ because it is less cold. On a number line, -143 is to the right of -180.

6. Triton is $10°C$ colder than Neptune. $-235°C$ is $10°$ lower than $-225°C$. On a number line, -235 is to the left of -225.

7. There are no negative integers on the Kelvin scale. The coldest possible temperature is given a value of zero (absolute zero), so all other temperatures must be positive numbers.

8. a. The size of one degree on the Celsius scale is the same size as one degree on the Kelvin scale.

b. Each number on the Celsius scale is 273 less than the corresponding number on the Kelvin scale.

c. Add 273 to a temperature on the Celsius scale to convert it to a temperature on the Kelvin scale.

9. a. $20°C = (20 + 273)°K = 293°K$

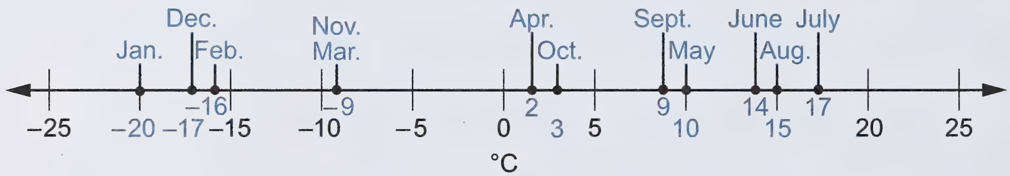
b. $100°C = (100 + 273)°K = 373°K$

c. $-100°C = (-100 + 273)°K = 173°K$

10. It is easier to use and compare two numbers if both of them are positive. Also, when the work done by scientists involves extremely cold temperatures, the Kelvin scale makes calculations simpler.

Activity 2

1.



2. a. The average monthly temperatures have a range of $37°C$. From $-20°C$ to $0°C$, there are $20°C$; and from $0°C$ to $17°C$, there are $17°C$.

$$20°C + 17°C = 37°C$$

b. The average temperature is $31°C$ higher in June than in December. From $-17°C$ to $0°C$, there are $17°C$; and from $0°C$ to $14°C$, there are $14°C$.

$$17°C + 14°C = 31°C$$

c. It is $0°C$ lower. November and March have the same average temperature $(-9°C)$.

3. The temperatures, from least to greatest, are $-20°$, $-16°$, $-14°$, $-14°$, $-11°$, $-10°$, and $-9°$.

4. a. The average temperature in Grande Prairie is 6°C colder in January than the average January temperature in Calgary. From $-16°\text{C}$ to $-10°\text{C}$, there are 6°C.

   b. The average January temperature in Medicine Hat is 3°C warmer than the average January temperature in Edmonton. From $-14°\text{C}$ to $-11°\text{C}$, there are 3°C.

   c. The average January temperatures in Edmonton and in Red Deer are 5°C colder than the average January temperature in Lethbridge. Count back 5°C from $-9°\text{C}$. This takes you to $-14°\text{C}$.

5. a. The depth of the Mariana Trench is 2074 m greater than the height of Mt. Everest.

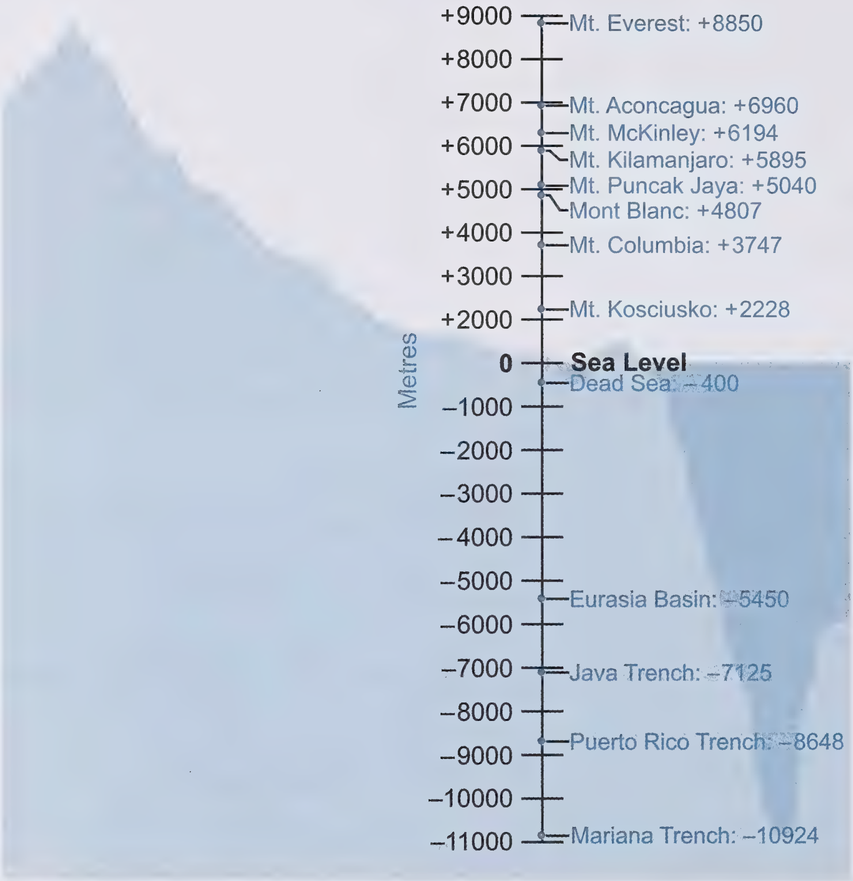
   $$10\,924\text{ m} > 8850\text{ m, and } 10\,924\text{ m} - 8850\text{ m} = 2074\text{ m}$$

   b. It is about 20 000 m from the top of Mt. Everest to the bottom of the Mariana Trench.

   10 924 m is about 11 000 m, and 8850 m is about 9 000 m.

   $$11\,000\text{ m} + 9000\text{ m} = 20\,000\text{ m}$$

6. The points are shown on the following vertical number line.



7. The places listed in order, from deepest to highest, are Lake Assal, Death Valley, Bahia Blanca, Lake Eyre, the city of Victoria, city of Edmonton, Baldy Mountain, city of Calgary, Cypress Hills, Mt. Caubrick, and Mt. Nirvana.

Activity 3

1. Answers will vary. Sample answers are given.

   a. The five vegetables you most prefer, in order from most favourite to least favourite, are carrots, corn, peas, potatoes, and celery.

   b. The five vegetables you most dislike, in order from strongest dislike to weakest dislike, are squash, beets, parsnips, broccoli, and spinach.

2. Answers will vary. Sample answers are given.

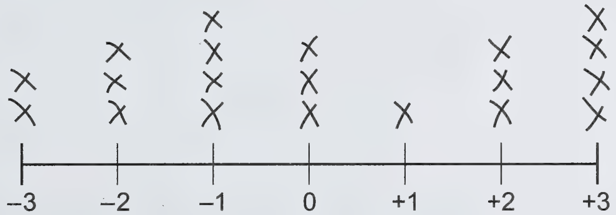
   a. $+5$ would represent your most favourite vegetable (carrots).

   b. -5 would represent the vegetable you most strongly dislike (spinach).

   c. The remaining vegetables are peas $(+4)$, corn $(+3)$, potatoes $(+2)$, celery $(+1)$, squash (-1), beets (-2), parsnips (-3), and broccoli (-4).

   d. You would have a neutral feeling for a vegetable if you give it a zero. (You neither like nor dislike it.)

3. a.

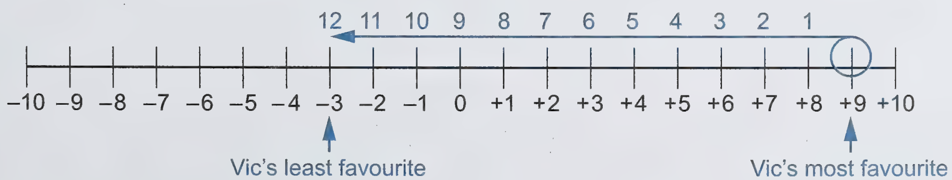


   b. Answers will vary. A sample answer is given.

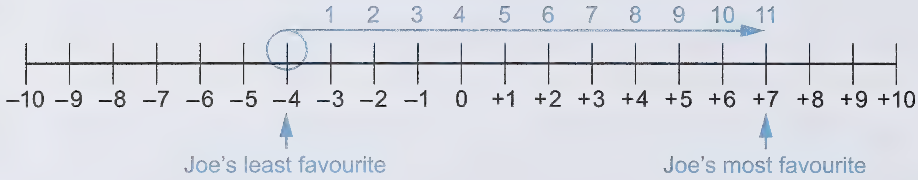
   Shyler: I counted 8 people who liked broccoli and 9 people who didn't like broccoli. Since more people didn't like broccoli, I think this shows that broccoli is unpopular with the people surveyed.

   Gabrielle: I think it is important to compare how many people's votes are at the opposite ends of the scale, where people's feelings are stronger. Seven people chose either $+2$ or $+3$, but only 5 people chose either -2 or -3. This tells me that the people who liked it had stronger feelings about it than those who disliked it.

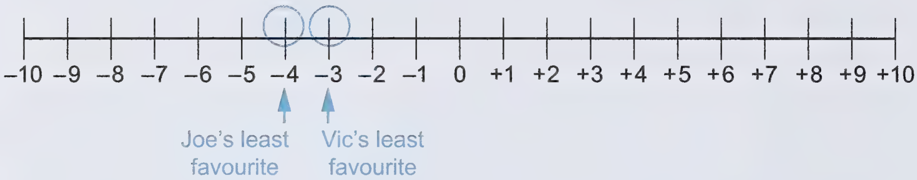
4. a. Vic rated his least favourite movie as a -3. Start at $+9$ and count 12 spaces to the left. You end up at -3.



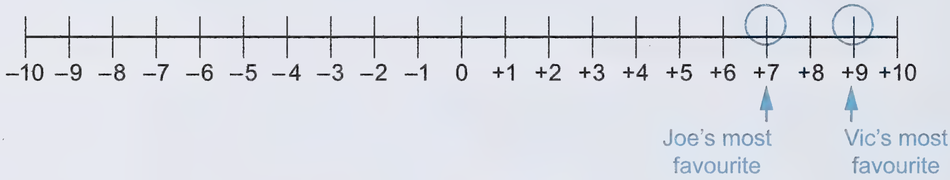
b. Joe rated his most favourite movie as a $+7$. Start at -4 and count 11 spaces to the right. You end up at $+7$.



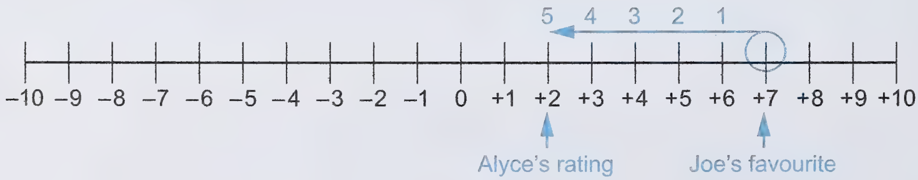
c. Joe gave a lower rating to his least favourite movie by 1 number. Vic's least favourite was rated -3 and Joe's least favourite was rated -4.



d. Vic rated his favourite movie 2 higher. Vic's most favourite was rated $+9$, and Joe's most favourite was rated $+7$.



e. Alyce's rating of the movie was $+2$. Circle $+7$ for Joe's favourite and count five spaces to the left. You end up at $+2$.



f. David's rating of the movie was $+1$. Circle -3 for Vic's least favourite and count four spaces to the right. You end up at $+1$.

5. Integers are useful for rating scales for the following reasons:

- The three categories of feeling (like, dislike, and neutral) relate well to the three categories of integers (positive, negative, and zero).
- Within each category, the size of number chosen tells how strongly you feel.
- It's easy to compare choices.

Challenge Activity

1. Tigger's score for the game is 45. If she made 1 shot on the ninth hole, then work backwards to get her scores on the first eight holes.

$$1+2+3+4+5+6+7+8+9=45$$

2. The sum of the par values is $3+3+4+5+3+3+6+4+5=36$. Tigger's score relative to par is $+9$.

Keystrokes

1. a. $90\ 000\ 000 + 8\ 000\ 000 + 400\ 000 + 60\ 000 + 5000 + 200 + 10 + 1 = 98\ 465\ 211$
   b. $20\ 000\ 000 + 2\ 000\ 000 + 50\ 000 + 60 + 4 = 22\ 050\ 064$
   c. $10\ 000\ 000 + 100 + 70 = 10\ 000\ 170$
   d. $10\ 000\ 000 + 5\ 000\ 000 + 500\ 000 + 5 = 15\ 500\ 005$

2. a. $0.2 + 0.01 + 0.004 = 0.214$
   b. $0.9 + 0.002 = 0.902$
   c. $0.3 + 0.05 = 0.35$ (A calculator will not display zero in thousandths place.)
   d. $0.06 + 0.001 + 0.0006 = 0.0616$

3. Subtract 328.

Keystrokes	ON/C	5328	−	328	=
Display	0	5328	5328	328	5000

4. Add 272.

Keystrokes	ON/C	5728	+	272	=
Display	0	5728	5728	272	6000

5. Add 672.

Keystrokes	ON/C	29328	+	672	=
Display	0	29328	29328	672	30000

6. Add 4398.

Keystrokes	ON/C	145602	+	4398	=
Display	0	145602	145602	4398	150000

7. Subtract 36 094.

Keystrokes	ON/C	236094	–	36094	=
Display	0	236094	236094	36094	200000

8. Add 23 906.

Keystrokes	ON/C	276094	–	23906	=
Display	0	276094	276094	23906	300000

Review

1. Nunavut: two million ninety-three thousand one hundred ninety

   $2\,000\,000 + 90\,000 + 3000 + 100 + 90$

   Quebec: one million five hundred forty-two thousand fifty-six

   $1\,000\,000 + 500\,000 + 40\,000 + 2000 + 50 + 6$

   Northwest Territories: one million three hundred forty-six thousand one hundred six

   $1\,000\,000 + 300\,000 + 40\,000 + 6000 + 100 + 6$

2.

Province or Territory	Total Area (km^2)	Rounded Total Area (km^2)
Prince Edward Island	5660	6000
Nova Scotia	55 284	60 000
New Brunswick	72 908	70 000
Newfoundland	405 212	400 000
Yukon	482 443	500 000
Manitoba	647 797	600 000
Saskatchewan	651 036	700 000
Alberta	661 848	700 000
British Columbia	944 735	900 000
Ontario	1 076 395	1 000 000
Northwest Territories	1 346 106	1 000 000
Quebec	1 542 056	2 000 000
Nunavut	2 093 190	2 000 000

3. **a.** The area of Nunavut (the largest territory) is about 350 times greater than the area of Prince Edward Island (the smallest province).

$300 \times 6000 \text{ km}^2 = 1\,800\,000 \text{ km}^2$ and $400 \times 6000 \text{ km}^2 = 2\,400\,000 \text{ km}^2$

$1\,800\,000 \text{ km}^2 < 2\,000\,000 \text{ km}^2 < 2\,400\,000 \text{ km}^2$, so the answer must be between 300 and 400.

b. The area of Nunavut is about 4 times greater than the area of the Yukon.

$4 \times 500\,000 \text{ km}^2 = 2\,000\,000 \text{ km}^2$

c. The area of Quebec is about 30 times greater than the area of New Brunswick.

$30 \times 70\,000 \text{ km}^2 = 2\,100\,000 \text{ km}^2$, which is very close to the area of Quebec

d. New Brunswick has an area about one-tenth the area of Alberta.

$$10 \times 70\ 000\ \text{km}^2 = 700\ 000\ \text{km}^2$$

4. Textbook, page 42, Practise Your Skills, questions 1 and 2

1. a. $1000 \times 100 = 100\ 000$

b. $1000 \times 1000 = 1\ 000\ 000$

c. $1000 \times 1\ 000\ 000 = 1\ 000\ 000\ 000$

2. a. $452\ 693 < 831\ 026$

b. $43\ 774 > 43\ 747$

c. $158\ 691 > 27\ 384$

d. $770\ 509 > 75\ 241$

5. Textbook, page 45, On Your Own, questions 1 to 7

1. 4.25 million is greater.

$$4.25\ \text{million} = 4\ 250\ 000\ \text{and}\ 24.3\ \text{thousand} = 24\ 300$$

2. 8345 million is greater.

$$8345\ \text{million} = 8\ 345\ 000\ 000\ \text{and}\ 2.5\ \text{billion} = 2\ 500\ 000\ 000$$

3. 999 999 999 is greater.

$$0.9\ \text{billion} = 900\ 000\ 000$$

4. 5.3 million is greater.

$$5.3\ \text{million} = 5\ 300\ 000\ \text{and}\ 57.8\ \text{thousand} = 57\ 800$$

5. It's likely rounded. The budget would be composed of many parts of exact answers.

6. It's likely exact. The number of minivans sold can be counted.

7. It's likely exact. The number of people attending the game can be counted.

6. Textbook, page 45, Practise Your Skills, questions 1 and 2

1. **a.** 12 000 000 **b.** 4 250 000
c. 5 300 000 000 **d.** 62 500 000

2. **a.** 100 000 **b.** 400 000 **c.** 1 000 000
d. 1 000 000 **e.** 24 300 000 **f.** 9 000 000

7. Textbook, page 58, Skill Bank from This Unit, questions 1 and 2

1. **a.** $76\,081\,887 < 97\,000\,000 < 102\,901\,106$

b. $9\,781\,921 < 91\,919\,214 < 97\,818\,214$

c. $630\,275 < 3\,467\,285 < 23\,410\,000$

2. **a.** $635\,280 > 90\,627$

b. $266\,529\,381 < 266\,529\,904$

c. $740\,002\,123 > 99\,056\,370$

d. $1\,000\,000 > 999\,964$

8. **a.** On Mercury, the apple would weigh 0.378 N.

$$(3 \times 0.1) + (7 \times 0.01) + (8 + 0.001)$$

b. On Jupiter, the apple would weigh 2.364 N.

$$(2 \times 1) + (3 \times 0.1) + (6 \times 0.01) + (4 \times 0.001)$$

c. On Uranus, the apple would weigh 0.889 N.

$$(8 \times 0.1) + (8 \times 0.01) + (9 \times 0.001)$$

9.

Planet or Moon	Weight of Apple (N)	Rounded Weight of Apple (N)
Pluto	0.067	0.07
Moon	0.166	0.17
Mars	0.377	0.38
Mercury	0.378	0.38
Uranus	0.889	0.89
Venus	0.907	0.91
Saturn	0.916	0.92
Earth	1.000	1.00
Neptune	1.125	1.13
Jupiter	2.364	2.36

10. a. The apple would weigh about 13 times greater on Venus than on Pluto.

$13 \times 7 = 91$ (0.91 is 13 times greater than 0.07.)

b. The apple would weigh about twice as much on Jupiter than on Neptune.

$2 \times 1.13\ \text{N} = 2.26\ \text{N}$, and the apple weighs 2.36 N on Jupiter.

c. The apple's weight on either Mars or Mercury would be about one-third of its weight on Neptune.

$3 \times 0.38\ \text{N} = 1.14\ \text{N}$, and the apple weighs 1.13 N on Neptune.

11. Textbook, page 58, Skill Bank from This Unit, questions 3 and 4

3. a. 1728 **b.** 86 **c.** 2859 **d.** 1

4. a. 8.7 and 8.72 **b.** 5.9 and 5.91 **c.** 12.0 and 12.01
d. 68.6 and 68.56 **e.** 0.1 and 0.07 **f.** 16.9 and 16.94

12. **Textbook, page 59, Skill Bank Looking Back, questions 5 and 8**

5. **a.** 248 000 **b.** 65.5 **c.** 7.32

8. **a.** $2.704 < 4.072 < 4.207 < 7.42$
b. $5.033 < 5.133 < 5.3 < 5.31$

13. **a.** Green chart: 16°C: Kamloops, April 24 and April 26
Yellow chart: 21°C: London, April 24
Pink chart: 21°C: Toronto, April 24

b. Green chart: $-11°C$: Athabasca, April 26
Yellow chart: $-13°C$: Regina, April 26
Pink chart: $-7°C$: Yellowknife, April 24

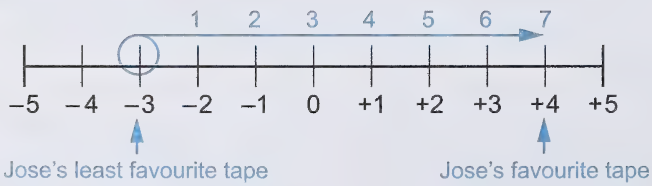
14. The temperatures are shown on the number line below.

15. **Textbook, page 144, Skill Bank from This Unit, question 5**

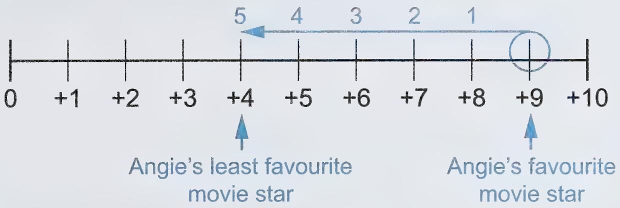
5. **a.** $+1 < +3$ **b.** $+4 > +3$ **c.** $0 < +2$
d. $+1 > -1$ **e.** $-2 < +5$ **f.** $-3 < 0$
g. $-6 < -5$ **h.** $-2 > -4$ **i.** $-3 < +6$

16. **a. Textbook, page 139, On Your Own, questions 1 and 2**

1. Jose's rating for his favourite tape was $+4$.



2. Angie's rating for her least favourite movie star was $+4$.



b. Textbook, page 139, Practise Your Skills, questions 1 to 6

1. $+9$ is 4 greater than $+5$ because it is 4 spaces to the right of $+5$.
2. -2 is 4 greater than -6 because it is 4 spaces to the right of -6.
3. $+8$ is 12 greater than -4 because it is 12 spaces to the right of -4.
4. $+7$ is 14 greater than -7 because it is 14 spaces to the right of -7.
5. $+3$ is 12 greater than -9 because it is 12 spaces to the right of -9.
6. 0 is 8 greater than -8 because it is 8 spaces to the right of -8.

17. Textbook, page 175, Skill Bank Looking Back, question 8

8. a. $0°C$ is 5° higher than $-5°C$. All negative integers are less than zero.

b. $+3°C$ is 9° higher than $-6°C$. Any positive integer is greater than any negative integer.

c. $-2°C$ is 2° higher than $-4°C$. -2 is closer to zero than -4 is.

18. Textbook, page 203, Skill Bank Looking Back, question 3

3. a. $+5$ is 2 greater than $+3$ because it is 2 spaces to the right of $+3$.
b. $+2$ is 3 greater than -1 because it is 3 spaces to the right of -1.
c. 0 is 3 greater than -3 because it is 3 spaces to the right of -3.
d. $+4$ is 4 greater than 0 because it is 4 spaces to the right of 0.
e. $+5$ is 10 greater than -5 because it is 10 spaces to the right of -5.
f. -2 is 2 greater than -4 because it is 2 spaces to the right of -4.

19. **Textbook, pages 56 and 57, Problem Bank, questions 1 to 5**

1.

Day	Number of Pennies
1	1
2	2
3	4
4	8
5	16
6	32
7	64
8	128
9	256
10	512
11	1024
12	2048
13	4096
14	8192
15	16 384
16	32 768
17	65 536
18	131 072
19	262 144
20	524 288
21	1 048 576
22	2 097 152
23	4 194 304
24	8 388 608
25	16 777 216
26	33 554 432
27	67 108 864
28	134 217 728
29	268 435 456
30	536 870 912

a. You would receive about 1000 pennies on Day 11.

b. You would receive about 100 000 pennies on Day 18.

c. You would receive about 1 000 000 pennies on Day 21.

d. You would receive about 1 000 000 000 pennies on Day 31.

e. You find all the answers by continuing to double the numbers on the t-table.

2.

Country	Population
Canada	29 000 000
Mexico	90 000 000
U.S.	250 000 000
World	5 800 000 000

3. a. You would need to travel around Earth about 25 times to travel 1 million kilometres.

$$25 \times 40\ 000\ \text{km} = 1\ 000\ 000\ \text{km}$$

b. You would need to travel around Earth about 25 000 times to travel 1 billion kilometres because 1 billion is a thousand million.

4. Answers will vary. A sample answer is given.

About 375 of these spiders could fit from the tip of my middle finger to the base of my hand. Each spider is a little less than 0.5 mm long. Therefore, it would take 2 or 3 spiders to measure 1 mm, and 20 to 30 spiders to measure 1 cm. I used 25 spiders/cm for my estimate, and the distance from the tip of my middle finger to the base of my hand is about 15 cm. Therefore, the total number of spiders is $15 \times 25 = 375$ spiders.

5. The largest butterfly's wing span is about 140 times greater than the smallest butterfly's wing span.

$$\frac{280\ \text{mm}}{2\ \text{mm}} = 140$$

Just the Facts

Multiplication and Division Facts

0	0	0	1	1
2	14	3	9	4
20	5	25	6	18
7	49	8	8	9
81	4	8	1	48

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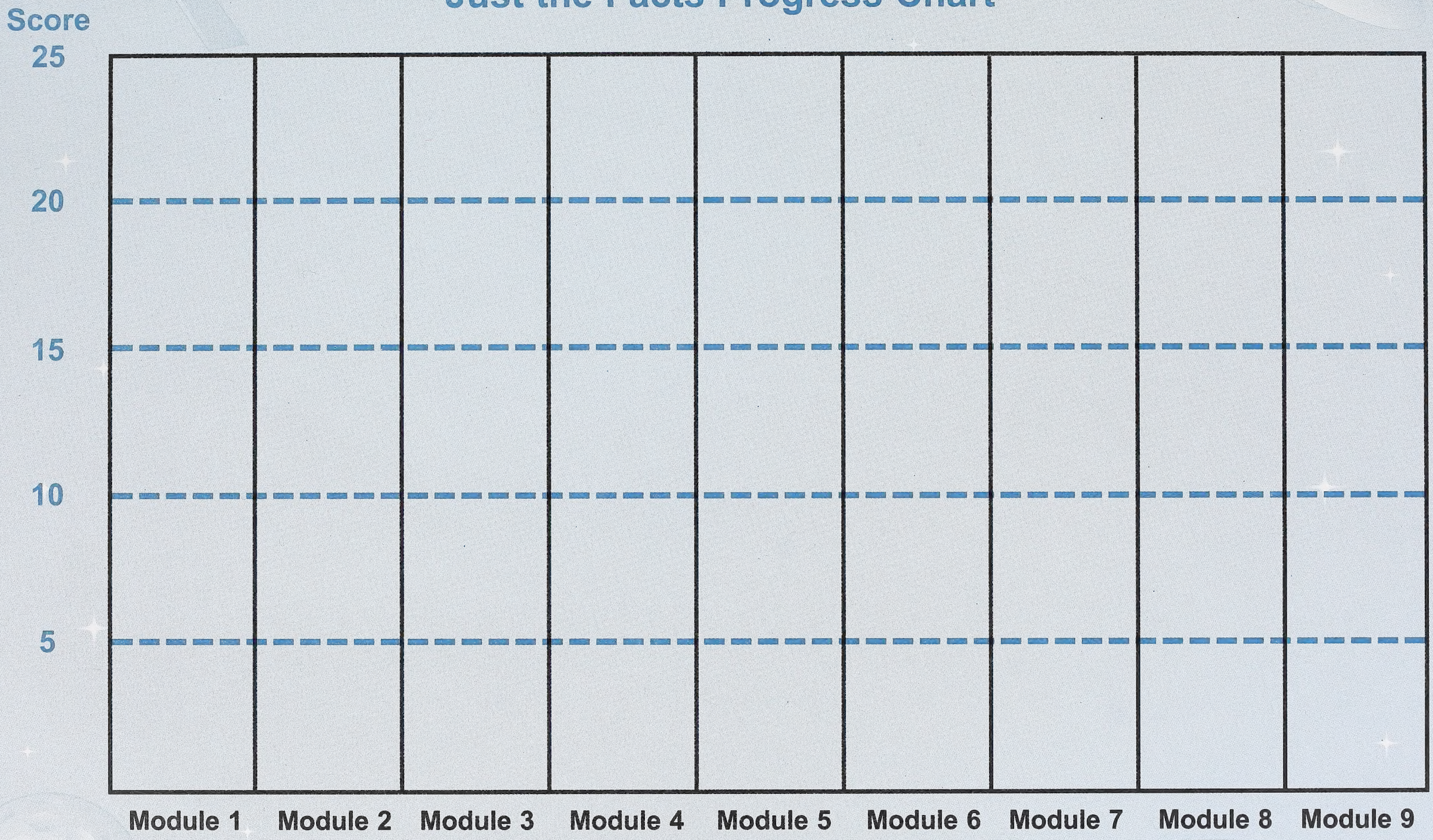
Just the Facts Progress Chart

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